Developments in Thermoplastic Elastomers

K. E. Kear

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Macromolecules
33, No.6, 21st March 2000, p.2171-83

Title

EFFECT OF THERMAL HISTORY ON THE RHEOLOGICAL BEHAVIOR OF THERMOPLASTIC POLYURETHANES

Pil Joong Yoon; Chang Dae Han
Akron, University

Authors and affiliation

Abstract

The effect of thermal history on the rheological behaviour of ester- and ether-based commercial thermoplastic PUs (Estane 5701, 5707 and 5714 from B.F.Goodrich) was investigated. It was found that the injection moulding temp. used for specimen preparation had a marked effect on the variations of dynamic storage and loss moduli of specimens with time observed during isothermal annealing. Analysis of FTIR spectra indicated that variations in hydrogen bonding with time during isothermal annealing very much resembled variations of dynamic storage modulus with time during isothermal annealing. Isochronal dynamic temp. sweep experiments indicated that the thermoplastic PUs exhibited a hysteresis effect in the heating and cooling processes. It was concluded that the microphase separation transition or order-disorder transition in thermoplastic PUs could not be determined from the isochronal dynamic temp. sweep experiment. The plots of log dynamic storage modulus versus log loss modulus varied with temp. over the entire range of temps. (110-190°C) investigated. 57 refs.

Location

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Developments in Thermoplastic Elastomers

K. E. Kear

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1 Introduction

Thermoplastic elastomers (TPEs), are a class of polymer materials which have the elastic behaviour of rubber and the processability of thermoplastics. Rubbers have been of strategic importance since the beginnings of the automotive industry. TPEs have become the most rapidly growing segment of the polymer industry. Freedonia Group forecast in November 2002 that world demand for thermoplastic elastomers will expand 6.4 percent per year, to 2.15 million tons in 2006 (37). The rubber industry has grown steadily but more slowly since the middle of the twentieth century and is facing slower growth than TPEs. The forecast is for global consumption of rubber to increase 3.8 percent per year to 21 million tons in 2006. TPEs have been developed since that time and are now rapidly developing and growing as we have entered the twenty-first century. TPEs represent only a fraction of the global rubber consumption and have a prognosis for higher growth rate on into the future. This important, growing area offers significant business opportunity for those who can capitalise on the capabilities of this class of materials. A thorough understanding of the trends in TPEs will provide an insight into those areas ready for commercial exploitation.

A treatment of the recent developments is very much in order in light of the high growth and continued evolution of this important polymer material field. In this review the structure, chemistry, performance and application of TPEs will be covered for the most recent 8 year history since the previous Rapra Review Report by J.A. Brydson (416).

Conventional rubber is a thermoset material. It consists of a filled polymer which typically contains a reinforcing filler, such as carbon black, a plasticising agent, such as mineral oil, one or more stabilisers, a crosslinking agent, commonly sulfur, several accelerators which increase the rate of crosslinking, and miscellaneous speciality additives as needed. The crosslinking reaction, called vulcanisation, or commonly, curing, is a rate limiting step in the manufacturing process to form conventional thermoset rubber articles. Much of the attention paid to forming these articles has focused on developing the formulations, known as compounds. These compounds must achieve the performance requirements and also chemically react in sufficiently controlled fashion to crosslink as quickly as possible at the time desired in the processing, but not prior. A vulcanised rubber cannot be reprocessed. It must be ground to a powder or crumb form to be recycled and then only as a filler material. Often it is treated as scrap and must be disposed of as waste. This limitation has been a source of economic and environmental concern for conventional thermoset rubber. Expended thermoset rubber goods pose an end-of-life disposal concern given their lack of recyclability.

Thermoplastic elastomers can perform as a rubber material. They also have the ability to be reprocessed when heated above the melt transition temperature. A TPE has the behaviour below the melt temperature of being elastic like a thermoset rubber. The source of this behaviour varies with the chemistry and structure of the various TPE materials as will be discussed. This ability to be reprocessed addresses the recyclability limitation of thermoset rubbers, thus there is little scrap when processing thermoplastic elastomers. This gives TPEs an important economic advantage. Also unneeded TPE articles can be remelted and reprocessed to recover the scrap material. Normally this is done by grinding the articles to make a TPE crumb that is mixed with virgin TPE during processing. This TPE capability provides an important environmental impact, as well as an economic impact.

These advantages over conventional thermoset rubbers coupled with a wide selection of performance capabilities and processing options give TPEs the promise to continue their high growth rate.

2 Structure of Thermoplastic Elastomers

The dual capability of elastomeric properties and recyclability are achieved using one of several approaches to prepare the TPE. The three major types of TPEs are:

- block copolymers,
- rubber/plastic blends and
- dynamically vulcanised rubber/plastic alloys, called thermoplastic vulcanisates.

Each of these achieves the elastic performance characteristic of a rubber in different fashions. A significant portion of the molecular make-up contributes to the elastomer-like performance in one phase. Another portion of the molecular make-up contributes a phase with thermoplastic properties. The dual phase nature combined with the chemistry of the polymer dictate the performance capabilities of the TPE.
2.1 Block Copolymers

The earliest TPEs were made by preparing tailored copolymer molecules consisting of a multi-block or tri-block copolymer structure. The end block of the copolymer molecules will crystallise. So these copolymer molecules are linked together when below the melting temperature, thus forming a virtually crosslinked network. Between these crystallised ends is the centre block which is amorphous and has rubber-like properties across the ambient temperature range. These block copolymers can be divided into classes based on their chemistry. They include:

- styrene block copolymers (SBC) (61, 130, 351),
- copolyesters (COPE) (291, 298, 364),
- thermoplastic polyurethanes (TPU) (228, 259, 355), and
- copolyamides (COPA) (183, 343).

The earliest TPEs were TPU block copolymers, discovered in 1952 by Snyder (a.1). While the initial TPUs were pursued for their use in elastic fibres, TPUs were developed starting with Schollenberger (a.2) for replacing thermoset rubber through the use of thermoplastic processing methods for thermoset rubber applications.

A simple picture of the structure of a TPE block copolymer, shown in Figure 1, illustrates how the rigid crystalline regions act as virtual crosslinks with the flexible rubbery blocks providing the overall flexibility of these copolymers. The rubbery blocks do not crystallise with the crystalline blocks. They form a continuous domain of softer, rubbery chains. These are held together by the crystalline domains which have the copolymer chains locked together in a crystalline structure. When these copolymers are deformed the hard blocks remain crystalline and do not deform. The soft rubber domain is easily deformed and provides rubbery behaviour. The recovery of these materials is good as long as the domains are not strained too greatly and the temperatures are well below the crystallisation temperature. Above the crystalline melt temperature the block copolymer chains are no longer locked into position and all the chains are free to flow. In the melt temperature range a block copolymer will process easily in typical thermoplastic processing equipment. This behaviour is exhibited by all the block copolymer TPEs.

To make the full range of commercially useful styrene block copolymers it is necessary to compound SBCs with extender oil/plasticisers to achieve soft flexible properties that are of interest to most users. The trend in recent years is to blend in other polymers or copolymers with the styrene block copolymers. The resulting alloy/blends have enhanced properties such as improved tensile properties or tear strength. A trend is to develop compounds that have extreme softness well beyond what was seen a few years ago. These new styrene block copolymer based TPEs can even have a gel-like softness which have hardness down into the 0 to 5 Shore A range. They have also been compounded to be transparent and colourless. They can be used in applications where transparency is desired and where the bright colouring achievable offers the desired appearance. Functionalised and saturated styrene block copolymers have also expanded the performance range of these TPEs into higher temperature ageing, improved fluid resistance, improved elastic recovery and set resistance.

![Figure 1](image-url)

**Figure 1**

Block copolymer morphology – illustration of hard blocks crystallised into domains with soft, rubber block regions between them
Developments in Thermoplastic Elastomers

The recent trend in block copolyester TPEs has continued to advance with enhanced features, such as improved blow-moulding processability, lower softness and high dynamic flexing fatigue performance. Heat ageing performance continues to be extended and new product grades are available from a variety of suppliers.

Developments have also continued in thermoplastic urethanes by extending their hardness range by introducing softer grades. TPU grades have also been introduced with improved injection mouldability. TPUs continue to be valued for their extreme toughness, abrasion resistance and fluid resistance.

A new development based on the new metallocene catalyst chemistry for polymerising olefins has lead to a different class of block copolymers. Controlled monomer sequences and molecular structure have allowed development of a technology to make high ethylene content copolymers with \( \alpha \)-olefins. They have been called polyolefin plastomers (POPs) and have greater elasticity, strength and improved processing (81, 414, 415). Similarly low ethylene content copolymers with \( \alpha \)-olefins, called polyolefin elastomers (POEs), have been developed that are much softer and are highly elastic yet thermoplastic (184, 224, 417). These new olefins have some similarity to the olefin blends, but have distinct advantages by having a crystalline section and a rubbery section in a single copolymer.

2.2 Rubber/Plastic Blends

One of the early type thermoplastic elastomers was prepared by blending a rubber and a thermoplastic polymer. The rubber and plastic polymers need to be somewhat incompatible with each other so that separate phases are formed. The most popular rubber/plastic blend is polypropylene with EPDM or ethylene-propylene copolymer (EP) rubber and is called a thermoplastic olefin (TPO). These polymers form separate phases. In some TPOs the EPDM rubber is partially or lightly crosslinked. The plastic phase is the continuous phase. The EPDM phase is generally discrete particles as shown in Figure 2. In some situations the rubber phase can be a cocontinuous phase. It is important to note that the TPO rubber phase morphology is not fixed. Without full crosslinking the rubber phase undergoes coalescence or rupture during high shear processing. The rubber particles also change shape freely. This allows a TPO to flow freely and results in good processing characteristics. Injection moulded and extruded TPOs also have a smooth surface appearance as a result.

The rubber/plastic blends and especially TPOs are relatively low cost materials. They enjoy wide use where temperature or fluid performance requirements are not excessively high. New developments in rubber/plastic blends are directly correlated to the development of new rubber or plastic polymers. Recent breakthroughs with metallocene catalyst technology in the development of new ethylene/\( \alpha \)-olefin copolymers have already begun to have an impact on the technology of TPOs commercially available. TPOs can now be made in the reactor as reactor TPOs (rTPOs) thereby reducing manufacturing costs. The rTPOs which have been available are harder and limited to Shore D hardness. Now new rTPOs have been introduced that are softer (a.3).

Nitrile rubber (NBR) and polyvinyl chloride (PVC) thermoplastic is another rubber/plastic blend that has commercial utility. The two polymers are similar...
enough to be nearly compatible with each other and yet form separate rubber and plastic phases. These polymers can also be plasticised with ester plasticisers. The relatively low melting point of PVC limits the upper use temperature. Both polymers are incompatible with hydrocarbon oils and fluids which gives the blend useful commercial properties.

**2.3 Thermoplastic Vulcanisates**

A third class of TPE is the thermoplastic vulcanisates (TPVs). TPVs are generally prepared by dynamic vulcanisation which was first carried out by Fisher (a,4, a,5), but he did not apply it to developing a fully cured EPDM rubber phase. The first fully cured EPDM/PP TPV was developed by Coran and Patel (419, a,6). TPVs have since grown rapidly in commercial use to become one of the leading TPE classes. A TPV is a blend of thermoplastic with fully crosslinked, i.e., vulcanised, rubber. The thermoplastic is the continuous phase and the crosslinked rubber is a dispersed particulate phase. TPVs are prepared by dynamic vulcanisation where the rubber phase is crosslinked during the mixing process when the polymers are mixed together. The rubber phase crosslinking is nearly 100% and must exceed 95% to have good fluid resistance, recovery and seal stress retention. The properties of TPVs approach those of a thermoset rubber because of the complete vulcanisation of the rubber phase. The best physical properties are achieved when the particles are about 1 µm in diameter as shown in Figure 3. In early work these morphological structures were determined with scanning electron microscopy (SEM) and transmission electron microscopy (TEM). In the 1990s the development of atomic force microscopy (AFM) has produced a powerful new tool to study the morphology of TPVs and TPEs (169).

TPVs are made with a variety of rubber and plastic pairs. The most common are the EPDM/PP TPVs. Butyl rubber and polypropylene is used for an isobutylene-isoprene rubber (IIR)/PP TPV (5). A compatibilised thermoplastic vulcanisate of nitrile rubber (NBR) and PP (NBR/PP TPV) is a higher fluid resistant TPE which has the same upper temperature limits as the EPDM/PP TPVs (69).

There are new developments in TPVs based on the dynamic vulcanisation of the higher temperature rubber and plastic combination ethylene-acrylate rubber and polyester (polyethylene terephthalate (PET) or polybutylene terephthalate (PBT)). These new TPV developments have recently been commercialised by DuPont. Another new TPV based on silicone rubber called TPSiV has been developed and commercialised. These TPVs provide higher temperature and/or higher fluid resistance than the PP based TPVs (30, 80).

The available TPV products have also been expanded by developing new grades which have improved characteristics (175, 374). Next generation TPV products have been developed that have very low hygroscopicity and can be processed without drying. These next generation TPVs also have very high colourability. They require less colorant and lighter, brighter colours may be achieved. These TPVs are commercialised with specific grades optimised for processing by extrusion or by injection moulding.

TPV products which have bondability to a variety of substrates have been introduced. Bonding to nylon was introduced first (360). Later, TPVs which bond to ABS were introduced. More recently, TPVs were introduced which have bondability to textiles, many thermoplastics and metals (106, 121, 209). These newest bonding TPVs also have utility as a tie layer to other polymers.

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![Figure 3](image3.png)

**Figure 3**
Thermoplastic vulcanisate morphology with continuous plastic phase and discrete rubber particles
Developments in Thermoplastic Elastomers

The nylon bonding and ABS bonding TPVs are generally used in insert or two shot injection moulding. TPV product enhancements also include grades that have better injection mouldability, appearance and lower hardness.

3 Chemistry of Thermoplastic Elastomers

The chemistry of the different types of TPEs varies over a wide range. Addressing these variations in a general way will help establish the relative capabilities of these TPEs. Polymerisation chemistry itself is a very broad topic and will not be addressed in this review. The focus will be given to the chemical nature, in order to understand the ramifications it has for the utility of the TPE.

3.1 Block Copolymer Chemistry

Styrene block copolymers have a chemical structure as shown in Figure 4.

These styrene block copolymer chemical structures show that the end blocks of styrene are the regions that participate in the crystalline domain of the TPE. The rubber properties are defined by the middle block of butadiene, isoprene or ethylene-butylene. The butadiene and isoprene blocks are unsaturated with the residual double bond in each repeating unit. This makes the rubber portion subject to oxidation and ozone attack. This limits the utility to applications where the maximum temperature remains 70 °C or less on an extended basis. The maximum upper use temperature is dictated by the temperature at which the styrene regions melt. The hydrocarbon nature of the polymer chain makes these SBCs resistant to water and many aqueous solutions.

A SBC is generally compounded with plasticising oils and fillers added to generate the mechanical properties desired. The oils soften these styrene block TPEs so very low modulus and flexibility is attained. The oil is extractable in hydrocarbon fluids and solvents so they are not used in areas with oil, fuel and solvent exposure. The oils would be generally extractable by aqueous detergent solutions.

New developments have been published regarding the modification of the rubbery mid-block with controlled
distribution of styrene monomer units (a.7). These have been developed with higher styrenic content and yet control the morphology as highly ordered cylindrical or spherical rubbery domains without switching to the lamellar morphology which introduces plastic yielding behaviour. These have been commercialised by Kraton Polymers under the trade name Kraton® A. Also enhancements to SBC chemistry by an alloying process with higher performance plastics has been published using polyphenylene ether (PPE) with a SEBS, and compounded including oil and PP to achieve performance enhancements by combining the chemistry of the several phases (a.8).

A TPU is prepared from three types of chemicals: an isocyanate, a macroglycol and a chain extender to form a multiple hard/soft block structure. The isocyanates can be aromatic or aliphatic and are difunctional. A typical example is methylene diphenyl 4,4’-diisocyanate (MDI). Macroglycol reacts with the isocyanates to form a soft block in the TPU backbone. The chemical nature of the macroglycol defines the performance of the TPU. Longer macroglycols give a more flexible TPU. The chemistry, e.g., polyester, polyether or polycaprolactone, will affect the chemical resistance, oxidation resistance, hydrolytic stability and low temperature flexibility. Chain extenders react with isocyanate forming the rigid urethane blocks in the TPU backbone. Chain extenders are typically diols or diamines. Short extenders will give more urethane segments, which make the TPU more crystalline, tougher and higher strength. Typical chemical structures of TPU block copolymer components are shown in Figure 5.

TPU rigid domains have a high melting point dictating the upper temperature use suitability for this class of TPEs. The rubbery region is saturated and has polar bonds connecting the repeating units. This imparts high oil and solvent resistance to hydrocarbon fluids and a resistance to ageing. The rubbery regions are relatively short and less flexible than seen in a SBC block copolymer. The hardness tends to be limited to a higher durometer range because of these shorter rubbery blocks. Therefore, these TPUs do not lend themselves to compounding and addition of plasticising oils. The limitations common to plasticised compounds are not seen in TPUs. Softer grades are made by employing a longer, more flexible monomer in the rubber blocks. The high polarity of TPU makes it absorb moisture, which must be removed when processing. A TPU modified with an acrylonitrile-styrene-acrylate (ASA) elastomer has been introduced which produces a softer TPU with improved melt strength and reduced melt sticking (a.9).

COPE is made from a hard polyester block and a soft polyether or polyester. Use of a soft polyester block is the newer approach for COPE. So COPE is either a copolyether-ester or copolyester-ester. A common copolyether-ester COPE uses polybutylene terephthalate (PBT) polyester for the hard domain and polytetramethylene glycol (PTMEG) for the soft domain. DuPont manufacture Hytrel® grades and DSM produce these TPEs in their Arnitel® range. A relatively high soft domain proportion in the COPE results in a softer TPE. The reverse relationship results in a hard
Developments in Thermoplastic Elastomers

TPE with properties approaching that of PBT. A typical polyester block copolymer chemical structure is shown in Figure 6.

The polyester crystalline domains provide a higher melting temperature for the rigid regions of COPE. The flexible polyether rubber domains provide a tougher and oil/solvent resistant rubber domain. The hardness of these TPEs is also high due to these rubber domains. These TPEs are generally used in the pure state without compounding, so some of the disadvantages of plasticiser oil extraction and volatility are not seen with these materials. The mechanical strength of COPE is high due largely to the strength of the highly crystalline PBT domains. COPE has a higher strength and hardness than TPV and SBC, in general, and is in the range of TPU and COPA. But the elastic recovery, tensile set and compression set resistance are not as good. The newer polyester-ester COPEs have higher peak temperature capability of up to 185°C. Like TPU the polarity of COPE makes it readily absorb moisture, so it must be dried before processing.

3.2 Rubber/Plastic Blend Chemistry

TPO blends of EPDM rubber and polypropylene plastic are the most commonly used of the rubber/plastic blend TPEs. The chemistry of the two individual phases is a similar olefinic chemistry which has a saturated backbone chain. This saturated backbone provides resistance to oxidative attack, so the TPOs exhibit excellent ageing resistance. The hydrocarbon fluid resistance of EPDM is low so TPOs have limited ability to be used in contact with oils, hydrocarbon solvents and fuels. The resistance to water and aqueous solutions is excellent. Most commercial TPOs are compounded to achieve lower cost and have plasticising oil and fillers added to provide the desired properties. Many commercial TPOs are also partially crosslinked. Historically the common crosslinking agent is peroxide. Crosslinking improves the toughness, tensile properties and fluid resistance of a TPO. TPOs can be compounded to be soft and flexible. Compounded TPOs are subject to oil extraction in many solvents.

The NBR/PVC blend has a polar chemistry for both phases (418). NBR is a copolymer of butadiene and acrylonitrile. The acrylonitrile leaves a very polar nitrile group functionality appended to the chain backbone. The butadiene leaves large residual unsaturation in the polymer backbone. So NBR is subject to oxidation as the other diene based rubbers are. The nitrile functional group can be varied in NBR to increase the polarity and the resistance to hydrocarbon fluids, oils and fuels. However, without complete crosslinking the resistance falls short of that found in a thermoset NBR compound. PVC has the chlorine functionality along the backbone which adds polarity and also the plastic phase. The relatively low melting point of PVC limits the upper use temperature of this blend TPE. PVC has relatively good ageing resistance compared to unsaturated hydrocarbon based rubbers, but the NBR phase will be the weak point attacked by oxygen during heat ageing. Hydrogenated NBR (HNBR) is used in some of the NBR/PVC blends to achieve a saturated backbone in the NBR rubber phase. No residual double bonds are left in the HNBR chain backbone which eliminates the sites which are most susceptible to oxygen attack. This dramatically increases the ageing resistance of HNBR. The HNBR/PVC blends reach the ageing performance range seen in the EPDM/PP blends but with much improved fluid resistance, although they still have a lower maximum use temperature due to the lower melting point of PVC. Hydrogenation of NBR adds significantly higher expense to these HNBR/PVC blends.
3.3 Thermoplastic Vulcanisate Chemistry

The dominant TPV in use is the EPDM/PP TPV. It was first commercialised as Santoprene® rubber (Advanced Elastomer Systems L.P. an affiliate of ExxonMobil Chemical Co.) and is now available from a variety of suppliers. The chemistry is based on using a vulcanising agent added to the EPDM rubber as it is blended with the PP phase. The process achieves a vulcanisation crosslinking that happens dynamically while the TPV is mixed. The process has been called ‘dynamic vulcanisation’. The very first patents covered sulfur-based vulcanisation chemistry and peroxide vulcanisation. A key subsequent patent on the process covered the use of phenolic resin curatives. EPDM/PP based TPVs have a fully saturated backbone in both the vulcanised EPDM rubber phase and the PP plastic phase. This provides these TPVs with a high degree of heat ageing resistance. This resistance has been augmented in some commercial grades by the use of appropriate stabilisers and UV protection systems to achieve very high ageing resistance for the EPDM/PP TPVs. With the expiration of basic original composition and process patents a variety of suppliers have introduced EPDM/PP TPV products.

The TPVs have complete crosslinking of the rubber phase. They achieve a greater than 95% efficiency of crosslinking of each rubber molecule in the rubber phase domains. This crosslinking along with the saturated nature of these EPDM/PP TPVs gives these materials properties very much like a thermostet rubber. The EPDM/PP TPVs have good elasticity. The PP plastic phase is semicrystalline and provides a high level of fluid resistance to these materials. The EPDM rubber particles appear to be protected by encapsulation in the PP to give fluid resistance that is in the same class as neoprene (CR) and chlorosulfonated polyethylene rubber (CSM), e.g., Hypalon®. PP has a high melting point so the PP phase provides a very good upper use temperature along with the excellent heat ageing resistance. The unique combination of chemistry for the EPDM/PP TPVs has positioned these materials at a very popular performance level.

New EPDM/PP TPVs have been commercialised in the last several years based on a new crosslinking chemistry by Advanced Elastomer Systems L.P. an affiliate of ExxonMobil Chemical Co. (128). The chemistry of these crosslinks gives an EPDM/PP TPV that has performance very similar to that of the previous TPVs, but with several important new advantages. The new EPDM/PP TPV crosslinker imparts little or no colour to the overall TPV. These new TPVs can be coloured to much lighter colours. Also the new chemistry is not hygroscopic, so the new TPVs do not pick-up moisture nearly as much as the established EPDM/PP TPVs. This provides a big advantage by eliminating the need to dry these new TPVs prior to processing. A slight disadvantage is that these new crosslinkers add some additional expense in comparison to the more conventional crosslinkers used for vulcanisation of the established TPV products. Over time this disadvantage could begin to disappear if the crosslinking agents increase in availability and drop in costs. The use of the new crosslinking agents has allowed the tailoring of the chemistry of the rubber and plastic phases to achieve TPV grades tuned for specific processes. Through careful selection of chemistry of the PP and EPDM phases, grades optimised for injection moulding and for extrusion have been commercialised.

TPV products have been available since the 1980s which also have butyl rubber and PP phases, (IIR/PP TPV), and compatiblised NBR/PP phases. In these the rubber phases are completely crosslinked using a dynamic vulcanisation process. There have been several recent developments with further chemistry. A TPV with a silicone rubber phase has been introduced by Multibase, a unit of Dow Chemical Co. The silicone rubber phase is fully crosslinked by a dynamic vulcanisation process with a nylon or polyester plastic phase. It has been coined a TPSiV. These plastic phases provide a very high melting temperature in combination with the high temperature resistance of vulcanised silicone rubber. The products are newly commercialised and offer high maximum temperature and high heat ageing capability. These plastic phases have a high polarity which will offset the moderate fluid resistance of a silicone rubber and gives the TPSiV a high hydrocarbon fluid resistance to oils and solvents. The fluid resistance puts the chemical resistance capability in the same range as epichlorohydrin rubber (ECO).

Another new class of high temperature performance TPV has been introduced by Zeon Chemicals that has a dynamically vulcanised polyethylene acrylate (AEM) rubber phase with a polyamide (PA) plastic phase (2). The rubber phase has a high polarity which is combined with the high polarity of the plastic phase to give very high hydrocarbon fluid resistance to these new AEM/PA TPVs. The high heat ageing resistance of the AEM rubber gives these TPVs good heat ageing at 150 °C.

Another TPV combination of an acrylic elastomer with COPE has been recently introduced by DuPont Engineering Polymers (a.10). The vulcanised acrylic elastomer is dispersed in a COPE matrix. Hardness ranges from 60 to 90 Shore A durometer. The
acrylic/COPE TPV has high heat resistance, oil resistance, low hardness, good creep resistance and is hydrolysis resistant. The product has been coined an ETPV due to its high engineering performance.

4 Properties of Thermoplastic Elastomers

One of the principle properties of a TPE is the elasticity. But many characteristics combine to render the various TPEs useful for any given application. Material performance and costs must be compared to the engineering requirements of a component when the decision is made about which TPE will be used. The nature of the TPE morphology and chemistry will define the overall performance of a TPE. Recent developments have expanded the performance capabilities of TPEs because of new breakthrough in polymers and alloying technologies.

4.1 Service Temperature, Ageing and Resistance to Oils

To help classify the general performance of TPEs which accounts for upper service temperature, resistance to oils and ageing, performance is shown versus their relative cost in Figure 7. The higher performance materials have higher resistance to oils and hydrocarbon fluids and/or higher upper use temperature and ageing resistance. New TPEs on the comparison chart are high performance areas, including the ethylene-acrylate rubber (AEM TPV) and the silicone rubber/polyester or polyamide TPV (TPSiV). They offer high fluid resistance with much higher upper use temperatures. What is not obvious from the simple two-dimensional diagram is that these new TPEs are much softer and more flexible than TPU, COPE and COPA. Other TPE performance characteristics can be compared to uncover the important contrasts between the various TPEs.

While cost/performance ranking is a general way to categorise TPEs there are distinct differences between them. An important set of performance properties that distinguish them is the resistance to swelling in hot oil and the maximum service temperature. The use temperature versus oil resistance performance of the TPEs is shown in Figure 8a. The performance rating for the thermoset rubbers is shown in Figure 8b. A review of the thermoset rubbers shows the competitive positioning of the TPEs. The new TPEs, AEM TPV and TPSiV fall into the upper right corner providing a higher performance in an important performance
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niche for soft TPEs. These will be the high value and typically lower volume usage applications. In the lower left corner the rTPO, POP and POE are new olefin TPEs offering performance that can meet the high volume applications which are quite cost sensitive. The new POE, POP and rTPOs entering the market show that the suppliers are continuing to work toward meeting the market needs at all ranges of the performance spectrum.

A related recent development is elastomeric polypropylene (ePP) (57). It is an isotactic homopolymer prepared using an asymmetric, metallocene catalyst that introduces stereo errors along the isotactic chain. The properties range from rigid semicrystalline to flexible thermoplastic elastic. These properties give characteristics to the new material such that it can compete with TPEs and flexible PVC in some applications.

Figure 8

(a) TPE performance – comparison of service temperature versus oil resistance
(b) Thermoset rubber performance – comparison of service temperature versus oil resistance

Notes: MPR = melt processable rubber (Alcryn® from Advanced Polymer Alloys a division of Ferro Corp. (165)), FVMQ = fluorinated silicone rubber, VMQ = silicone rubber, T = polysulfide rubber, FKM = fluoroelastomer
4.2 Hardness

Another principal performance comparison between TPEs is the hardness range in which they are available. The chart in Figure 9 shows the approximate hardness range of the various TPEs which are currently available. The comparison to thermoset rubber shows that the hardness range of TPEs typically exceeds that of thermoset rubbers. One notable difference in the hardness range is that the SBC compounds are now available in softness ranges that go below the Shore A durometer range and are reported in the Shore 00 durometer scale. These gel-like TPEs have a unique softness performance range. The hardness range of the EPDM/PP TPVs is being extended to the under 20 Shore A range. A softer TPV will provide soft TPEs with high recovery and fluid resistance. The new rTPOs extend their hardness to the low range where they have not previously been available. POP and POE have olefin type performance in the range of the TPOs.

In soft touch applications very soft TPEs are in great demand for the perceived value they add. The lowest softness or durometer hardness is achieved by SBC compounds. Other soft materials include: TPV, TPO, MPR, NBR/PVC and some TPUs. Performance in softness is often also connected with perceived ease of grip. This perception is also related to the friction coefficient when the TPE is wet. TPV and TPO have excellent wet friction. SBC has good wet friction. The new TPSiV has a silky feel to the touch. A new EPDM/PP TPV also has a more silky touch, it is the Santoprene® rubber 8000 series of TPVs from Advanced Elastomer Systems.

There are a great many performance attributes that may be used to compare TPEs which have relevance in specific applications. Properties which have wide interest include: abrasion, clarity, tensile/tear strength, oxygen/air barrier resistance, softness, adhesion/bondability and elastic recovery.

Figure 9

TPE hardness range comparisons
4.3 Abrasion Resistance

Abrasion resistance is important where dragging, rough handling, industrial use and friction contact may be involved in the TPE application. The hard TPEs generally have better abrasion resistance. Excellent abrasion resistance is achieved by TPU and COPA. Good abrasion resistance is obtained with MPR, COPE, TPV, TPO and NBR/PVC.

4.4 Clarity

Clarity is attained only by a few TPEs including: styrene block copolymers and TPU. TPO can have translucence and is nearly clear in some instances. Most TPEs are opaque. Some translucent grades of TPVs have been developed.

4.5 Tensile Strength and Tear Resistance

Tensile strength and tear resistance are key issues in some applications. Typically hard TPEs have the better tear resistance and tensile strength. Excellent tensile/tear strength is achieved by TPU, COPA and COPE. Good to very good tensile/tear strength is seen in TPVs, MPR, TPO and SBC.

4.6 Barrier Properties

The air and oxygen barrier resistance of most TPEs is only fair. Most TPEs will contain gases, e.g., oxygen, nitrogen, etc., for several days or even weeks depending on the thickness of the part and the temperature. However, for near excellent gas barrier resistance IIR/PP TPV is used. The butyl rubber phase in IIR/PP TPV provides high gas barrier resistance.

4.7 Adhesion and Bondability

Adhesion and bondability is an important performance characteristic when TPEs are moulded over a substrate or assembly bonded. In general TPEs with polar chemistry have excellent bondability. Many common substrates are polar materials so the polar TPEs are compatible and can form a good bond. Excellent adhesion is attained in many cases with: TPU, COPE, AEM TPV, TPSiV, SBC and COPA where the substrate polarity is similar enough. For nonpolar substrates, e.g., polypropylene or polyethylene, the EPDM/PP TPV, TPOs, IIR/PP TPV and NBR/PP TPV have excellent compatibility and can be overmoulded or heat welded. However, these TPVs and TPOs typically are relatively difficult to bond without use of an adhesive to form a chemical tie layer between the TPE and the substrate. New TPV grades have been developed that have excellent bonding in overmoulding and heat welding to most conventional substrates (70).

4.8 Elasticity

An important area for performance of TPE is the elasticity. Developments have been made in research to understand the performance and source of the elastic recovery seen in TPVs. It is an enigma that a TPV which has a continuous network of thermoplastic phase with dispersed rubber domains has an elastic recovery that is very much like that of the rubber. The continuous plastic phase has less effect on the ability of TPEs to recover after very high deformations than intuition might lead one to guess. Some extensive research in this area has been published during the last few years on characterising and studying the mechanisms of elastic recovery of TPVs.

Boyce, Kear and co-workers have studied EPDM/PP TPVs (a.11) mechanics and recovery, and effects of rubber particle to plastic matrix interactions. In these studies it is shown that the recovery of TPVs can be modelled with a new constitutive theory which includes a viscoplastic component. The model successfully captures and predicts the significant features of TPV stress-strain behaviour during loading including a relatively stiff initial response, followed by a yield-like event, then followed by a strain hardening and strain stiffening. The Boyce, Kear, Socrate and Shaw model also captures the basic features of TPV unloading behaviour, including enhanced stiffness upon initial load reversal followed by nonlinear unloading behaviour which leads to extensive recovery as seen in TPVs. Boyce and co-workers (a.12) studied the rubber-plastic phase morphology and interactions using a finite element analysis (FEA) simulation of TPV mechanical behaviour. The simulation study reveals the important role of relative matrix ligament thickness as well as geometric asymmetry in the formation of a pseudocontinuous rubber phase which explains the rubber-like behaviour of TPVs during loading. During deformation thinner ligaments of the PP plastic matrix yield and this leads to formation of the pseudocontinuous rubber phase. The bulky PP plastic regions undergo rotation and translation only during the loading, thus acting nearly like a rigid filler.
particle. Upon unloading the rubber phase particles in the TPV attempt to recover to their original shape. The bulk of the PP phase simply rotates and translates with the recovering rubber domains. The small amount of PP in the ligament region does exhibit some significant recovery, but not nearly to the extent of the rubber phase. As the recovery reaches completion the partially recovered PP ligaments undergo bending and buckling to facilitate the recovery. Calculations demonstrate that most of the PP phase is not involved in the deformation which is a key to explaining the high degree of rubber-like behaviour for TPVs.

In an extension of this TPV study Boyce and co-workers (a.13) used FEA simulation to study cyclic loading, unloading and reloading behaviour of TPVs. Experimental results are matched in the simulations with the TPVs softening after having been subjected to an initial load/unload cycle. The unloading behaviour is very similar to that seen in the first unload cycle. Simulation models reveal that the softening is a result of a reorganisation of the rubber particle/plastic matrix microstructural configuration. The previously extended PP ligaments are more easily deformed in the second cycle, and the bulky PP regions more easily translate and rotate into a position reached on the first cycle. The work has also identified a defined morphology for optimum recovery in TPVs (a.14).

In subsequent related experimental work on TPVs Oderkerk and Groeninckx (119) prepared a similar TPV with EPDM and a nylon plastic phase. Their infrared (IR) spectroscopy during strain showed a lower degree of orientation in the nylon phase than for pure nylon. Then upon recovery the nylon phase showed good recovery based on the IR response. The technique is similar to a study by Soliman and co-workers (329, a.15), who studied EPDM/PP TPVs and observed similar behaviour. An Huy and co-workers (188) also reported on Fourier Transform Infrared Spectroscopy (FTIR) of EPDM/PP TPVs. The PP crystalline phase orients during extension and upon unloading the orientation recovery is complete. In further work by Oderkerk and co-workers (83) on EPDM/PA6 TPV, AFM testing was conducted on specimens which are step-wise extended. They demonstrated that TPV microstructure deformation is very inhomogeneous. The TPV plastic phase deformation is initially concentrated in those regions where the plastic nylon matrix is the thinnest. During recovery the highly stretched rubber particles pull back the highly deformed plastic ligaments which exhibit bending and/or buckling.

A different approach was taken by Wright, Indukuri and Lesser (24) using a microcellular theoretical model to simulate the mechanical behaviour of TPVs. A lattice of PP embedded with EPDM is modelled to simulate TPV deformation behaviour. They conclude that the model qualitatively simulates the TPV loading behaviour for high rubber compositions, but it works only at low strains for low rubber (high PP) levels. It does not adequately capture the amount of irreversible work observed in TPVs. While they developed an analytical solution which includes compositional information, they conclude it does not show how composition or morphology affects mechanical properties to any greater degree than the previous FEA analysis (a.11-a.13).

### 4.9 Flex Fatigue Resistance

The ability of an elastomer to be stretched or flexed repeatedly and resist the appearance and growth of cracks is flex fatigue resistance. While thermoset rubber compounds have been known as having very high flex fatigue resistance, the EPDM/PP TPVs are found to have superior flex fatigue resistance. Softer TPV grades have the best flex fatigue resistance.

### 5 Designing with Thermoplastic Elastomers

Elastomer component design is one of the important areas for developing a successful product. The three areas required to develop a successful application are: material, design and process (Figure 10). TPE selection will be based on mechanical properties, performance and chemical resistance criteria. Once selected the TPE will have influences on design issues for developing the successful component. Due to their dual nature TPEs have many similarities to concepts used in conventional thermoset rubber and for rigid thermoplastics. Specific design features must also be adapted to the selected process’ limitations and capabilities.

#### 5.1 Design Concepts

The very first step in the design development process is to take a broad look at the system in which the TPE component will work. Because the plastic processing of TPEs offers a great deal of design flexibility it is important to take a broad view of development,
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thinking of ways to consolidate components. Mating rigid components could actually be incorporated into the TPE component or jointly moulded to make a combined assembly. Consolidation of parts and combining functionality should be the mind-set of anyone developing a new component and it applies even more so to one who is using a new type of material with the great flexibility of processing options such as that seen in TPEs. Consolidation and functionality integration have the potential to offer great cost savings, assembly efficiency increases and significant improvements in the quality and consistency of the assembly system. This approach of consolidation will continue to drive much of the acceptance and application of TPE materials well into the future.

5.1.1 Hardness

Design concepts are similar to those used for thermoset rubber. The first basic concept to account for in a design is the hardness of the TPE, or the elastic modulus which roughly parallels the measured hardness. Harder TPE components will not deflect as much under a given loading force. The hardness of the material can be balanced by the thickness of the component. Thinner parts will require a lower load to deflect a given distance. A thick rubber block feels rigid even with a soft material. Many thermoset rubber designs are thick and bulky. When designing for a TPE it is preferable to use a thin wall thickness since a plastic process is most economical when parts can be cooled rapidly back below the melt temperature. To achieve this, TPE components can be designed to use a harder material which achieves the overall stiffness desired in the component. Where a thick wall must be employed, often other design features can be used to facilitate quicker cooling. For example, a thick section of a part can have holes or partially cored out areas to minimise the distance between the centre of the part (the point last to cool) and the outside surface.

5.1.2 Fabrication Considerations

This opens the discussion of design concepts which are similar to those for rigid plastic components. Consideration must be given to fabrication (see also Section 6.3). For example, design for injection moulding is required for three-dimensional solid parts and parts where more precise dimensions are needed. When developing a design for injection moulding one important concept is to have an idea of how the filling flow will proceed through the component during injection. Identify the location of a surface area where a gate or several gates would be located and the direction of flow with an estimation of the last section of the part to fill. In some components this is very difficult to do precisely and a mould filling analysis is required to get an accurate location of the point to fill last. Locate the gate in a non-critical area for the component. For instance, a critical sealing surface cannot have a gate located on it without compromising the sealing capability. The last point to fill is important...
because of the potential to get a slight flash or alternatively underfill, or more likely find a slight blemish. If the last point to fill is a critical area, then some design features may need to be adjusted to shift the point to a less critical area, or the gate would need to be relocated.

TPE parts are generally cored out and ribs or bosses used to obtain the three-dimensional space filling and rigidity desired in the component. This reduces cooling time and the weight of the part. The requirement for ribs and bosses in TPEs is that the rib or boss thickness should be less than 50 to 60% of the base wall thickness to avoid a sink mark on the outer surface.

An undercut in injection moulded TPE components is not as difficult to deal with as it is with rigid thermoplastics. In softer TPEs the component can quite commonly be ejected even with undercuts of several millimetres without any special tooling consideration. In a rigid plastic with an undercut the part or mould would be damaged if a component is ejected without designing a feature in the mould to move the metal out of the way. This makes designing for TPE parts for tooling considerations somewhat simpler.

Injection moulded TPE components need some draft angle, typically 0.5 to 1°, to ensure that the component can be readily ejected from the tool. Very few parts are designed with perfectly square walls because of this issue. When ejecting a component a vacuum is created under the component as it is ejected forward until the part releases from the wall. In some instances where a square wall is mandatory, a vent from the rear or other feature can allow the part to be ejected. Since TPEs are low in modulus, they are potentially more susceptible to ejection difficulty without good drafting or ejection venting consideration. Also, since TPEs have a high coefficient of friction a TPE component will have a greater tendency to stick in a mould unless some draft angle or design consideration is made.

5.1.3 Component Deformation

Another concept important to developing an appropriate design for a TPE component is to ascertain whether the component deformations are load driven or deflection driven. A component that is loaded by a fixed amount of pressure or stress will undergo deformations which vary depending upon the modulus of the TPE. A softer TPE with a lower modulus will deform to a much greater degree in such a component, so it is a load driven design. The design must accommodate the balance of material modulus and the part thickness to achieve the desired degree of deformation. For a deflection driven design the component generally works in a system where it will be deformed to a certain extent regardless of the modulus of the TPE used. In this type of component the modulus of the TPE will dictate the level of stress attained. A deflection driven component’s design will need to balance part thickness and material modulus, with the intent of controlling the stress levels attained and the amount of stress incurred by the mating system components.

5.2 Key Design Parameters

For developing a TPE component design there are several typical key design parameters which are used for the design development. These typical parameters would include items listed in Table 1.

<table>
<thead>
<tr>
<th>Table 1 Typical design parameters</th>
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<tbody>
<tr>
<td>• Consolidation opportunities or functionality combined</td>
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<tr>
<td>• TPE hardness/modulus</td>
</tr>
<tr>
<td>• Component dimensions (e.g., height, etc.)</td>
</tr>
<tr>
<td>• Wall thickness</td>
</tr>
<tr>
<td>• Deformation limits (e.g., maximum compression)</td>
</tr>
<tr>
<td>• Stress limits</td>
</tr>
<tr>
<td>• Mating component contact/maximum force limits</td>
</tr>
<tr>
<td>• Part tolerance versus assembly tolerances</td>
</tr>
<tr>
<td>• Desired surface texture</td>
</tr>
<tr>
<td>• Appearance requirements</td>
</tr>
<tr>
<td>• Tactile touch or friction</td>
</tr>
<tr>
<td>• Environmental conditions (e.g., heat, fluids)</td>
</tr>
<tr>
<td>• Manufacturing process to be used</td>
</tr>
<tr>
<td>• Process imposed limitations and requirements</td>
</tr>
</tbody>
</table>

Given that the TPE component designer has considered all consolidation and functionality combinations, the next step is the design parameters to be assessed and incorporated into the component. This task is generally the most difficult and generally best done with the combined input of all who have a stake in the final component and system. A typical
list of people to include on a team to establish the
criteria would include: customers, marketing and
sales, business management staff, quality engineers,
manufacturing engineers, service/repair engineers,
material engineers, material supplier, cost
engineering, tooling engineers and tool makers. All
of these in addition to the design engineers have vital
input from their perspective on the final functionality
and expectations for the component. The list above
covers a few basics for a design but the detailed
expectations and functions should be agreed upon up
front to prevent catastrophic disappointments and
change of requirements late in the development. Late
changes often prove quite expensive and could
introduce unplanned, costly delays. The list should
have some prioritisation that is agreed upon by the
key functions and especially the customers. The list
should be quantified with ranges of acceptability and
tolerances if possible.

When developing a TPE component design some
general design capabilities should be used as guidelines
regarding ranges of variability and specification
tolerances based on experiences with the material and
process to be used.

5.3 Comparison with Thermoset Rubbers

Historically most elastomer components were made of
thermoset rubber and manufactured with vulcanisation
processes. There are some significant variations in the
TPE material and process capability to account for
when a thermoset rubber component is being
redesigned for TPE. Many users, e.g., customers,
engineers, or purchasing staff, have some expectations
that are based on experiences and familiarity with
thermoset rubber components. But the TPE component
needs to be optimised to fully take advantage of the
capabilities that the TPE brings. A few of the variations
from TPEs are shown in Table 2.

The traditional thermoset rubber geometry is often a
thick bulky shape. The parts use the bulk of the rubber
to perform its sealing, flexing, gap filling, and other
functions. Often rubber parts are covered in a waxy
zinc stearate film. Moulded rubber parts will have
extensive flash on them as moulded so they are always
deflashed, generally in a cryogenic tumbling process.
This process not only breaks off the flash at the
cryogenic temperature, but also causes some slight
damage and nicks in the final rubber part itself. This
deflashing has a substantial effect on the final

<table>
<thead>
<tr>
<th>Table 2 Factors influencing design in TPE versus thermoset rubber</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TPE</strong></td>
</tr>
<tr>
<td>Uniform thin wall</td>
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<td>Tighter dimension tolerance</td>
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<td>Flashless designs</td>
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<td>Multiple material</td>
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<td>Surface textures to 0.02 mm</td>
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<td>Hollow parts – by blow moulding</td>
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<td>Design analysis for lower property variation</td>
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<td>Initial set higher</td>
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<tr>
<td>Stress relaxation rate is low for TPVs after initial larger relaxation step</td>
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<td>Short-term upper temperature limit close to the melt temperature</td>
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<tr>
<td>Long-term upper temperature limited by polymer chemistry and varies widely</td>
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<td>Fluid and environmental limits determined by polymer chemistry and varies widely</td>
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dimensional tolerances of the thermoset rubber. TPEs can be moulded flashless and to tighter tolerances which makes it easier to design the elastomeric component to the desired dimensions. TPEs have a narrower hardness variation range of +/- 3 versus +/- 5 for thermoset rubber. This translates into less variation in the modulus and part stiffness. So when designing a part for a specific loading or amount of deflection, the variation in performance of a TPE component could be up to two times better (i.e., half the variation).

With TPEs one can use multishot moulding and have two or more materials moulded to make a component with a highly multifunctional design. TPEs come in blow moulding grades which is a very economical process used for thermoplastics. This process is a good choice for hollow components like convoluted ducts, flexible convoluted boots, and bottle shapes. Thermoset rubber must be moulded in a tool to form the inner geometry and then vulcanised. The unvulcanised rubber does not work in the blow moulding process. When doing a design analysis (e.g., by FEA) the variability in the modulus and mechanical properties of a TPE is about half that for a thermoset, so the TPE design can be made to a narrower envelope.

Another factor to design for with TPEs is the initial set they take upon their first loading. After several loading cycles, typically about 5 cycles, TPE, like EPDM/PP TPV will take no further set. Upon subsequent loading an EPDM/PP TPV component will exhibit very little additional set, unless the initial maximum loading strain is exceeded. A thermoset rubber exhibits the same type of behaviour, but the initial set taken is generally noticeably lower. But similarly after about 5 cycles the thermoset will stabilise to a specific value after loading and unloading cycles. The long-term stress relaxation of TPVs is very low due to the crosslinked rubber particles in the TPE, but the initial few minutes show some stress relaxation. Thermoset rubber has very low initial stress relaxation, but long-term relaxation is higher, especially with high temperature. After a period the TPV will exhibit better stress relaxation retention. The implication for designing sealing components and stress loaded components is to account for the higher initial relaxation and realise excellent stress retention in the seal. Sealing of TPVs and some of the other TPEs is quite good when the design accounts for the stress relaxation behaviour.

5.4 Set and Elastic Recovery

The sealing performance of a TPE or thermoset rubber is often assessed in a very approximate way by measuring the compression set. This test requires compressing a button of material to 25% compression and holding for a period of time, usually 24 h, then measuring the amount of the 25% compression that does not recover in a short time. This test is usually done at room temperature to assess ambient performance, but accelerated testing is done at 70 or 100 °C, as specified by ISO 3384 Method B. A similar accelerated test is the tension set test, where the TPE is stretched to 100% extension and held for 10 min. To determine the set the small dumbbell specimen is unloaded and measured to determine how much of the 100% extension did not recover. TPEs perform moderately well in these set tests at room temperature. The higher temperature tests show the limits that some TPEs have in upper temperature use. The higher TPEs, e.g., COPE, etc., are so rigid that the normal compression set test cannot be conducted. COPE has good recovery at low strain levels, but when designing for use the maximum expected strain must be kept in the 6 to 8% range to see this good recovery. TPVs and MPR have very good set performance even at the higher 100 °C temperature. SBC and TPOs have good set performance at room temperature, but at high temperature the set will generally exceed a 50% maximum desired set. While set is used to help identify better candidate materials for a component, the real performance parameter of interest is generally either the stress relaxation or the elastic recovery, whichever is more appropriate. For a static sealing application the stress relaxation as discussed above is the performance measure to account for in the design. For dynamic applications that are loaded and unloaded repeatedly, the elastic recovery is the performance measure to account for. As discussed earlier, the elastic recovery should stabilise after 5 load/unload cycles at a given maximum strain level. To develop an appropriate design the 5 cycle conditioned stress versus strain curve should be used for analysis and determining the appropriate design. The comments on the various TPE set characteristics apply directly to the elastic recovery performance comparisons for them. Data on the specific TPE and grade being evaluated for the component should be used to guide the design calculations.

5.5 Stress Relaxation

For static sealing applications the design performance can be assessed using the stress relaxation data. Data has been generated by vendors for the engineering class TPEs, notably the TPVs. For TPEs with less engineering application there is
not much data on stress relaxation available. Stress relaxation of the initial step from 0 to 30 minutes should be used in conjunction with longer term data from 30 minutes on. A total percentage stress relaxation can be estimated from these curves. For intermediate temperatures and time periods an estimation of stress relaxation can be obtained using the time-temperature superposition (TTS) principle. One way to use this TTS technique for EPDM/PP TPVs is presented by Narhi and Mehta (a.16). They have shown that TTS with stress relaxation data predicts pipe sealing performance of over 30 years at ambient temperature.

5.6 FEA Analysis and Hyperelasticity

FEA is a powerful simulation tool used for TPEs and thermoset rubber alike for analysis of the engineering performance of a design versus the performance specifications. It has become a very common tool in recent years, as the cost of powerful computers has dropped dramatically. FEA has been an important tool used by mechanical engineers for quite sometime on large sophisticated structures and critical components for many years. But the costs for FEA and the expertise requirements limited its application to all but the most sophisticated elastomer applications where engineering design is critical in the development process. One disadvantage of FEA for thermoset rubber is that the particular formulation and vulcanisation conditions dictate the mechanical stress versus strain properties of the rubber. In TPEs the mechanical properties of a particular grade are far more repeatable plus they are available as long as that grade is commercial. TPEs have a distinct advantage here that is directly parallel to rigid thermoplastics. TPEs have a distinct advantage that is directly parallel to rigid thermoplastics. The various TPEs have a wide range of rheological behaviour depending upon the chemistry and morphology of the TPE. Different rheological behaviour does not prevent a given TPE from being processed, but it does dictate the general extents and conditions of the processing window for the TPE. So a good overview understanding of TPE rheology and processing capabilities is in order. Rheological behaviour exhibited during polymer flow will approach one of the two limiting behaviours shown in Figure 11 after Kear (a.18). A Newtonian fluid maintains a constant viscosity when the shear rate is increased. A Power Law fluid has a decreasing viscosity when the shear rate is increased. Many typical thermoplastics transition from one behaviour to the other as the shear rate is increased. For the Power Law fluid the slope of the line on a log plot of viscosity versus shear rate is equal to 1-n, where n is the Power Law exponent. The magnitude of the viscosity will dictate the pressure required to get flow at a given rate. Some TPEs have a higher overall viscosity and exhibit Power Law behaviour, so that at very low shear the effective strength of the TPE melt is quite high. Other TPEs have a transition to Newtonian behaviour at very low rates like many typical thermoplastic polymers. This Newtonian behaviour allows the TPE melt to flow and deform easily at low shear rate. It is a good characteristic for injection moulding especially when combined with an overall low viscosity behaviour.

6 Fabrication of Thermoplastic Elastomers

TPEs are fabricated using the thermoplastic processes very much like the rigid thermoplastic materials. An understanding of the process capabilities and the rheological behaviour of the TPE are important to developing a robust process and attaining the best economics and quality for the TPE component.

6.1 Processing and Rheology Overview

The principal advantage of TPEs is that they can be used in a thermoplastic process where the material is melted, conveyed to a forming tool, shaped and then cooled quickly to obtain the finished component. The concept and issues are basically the same as for rigid thermoplastics. The various TPEs have a wide range of rheological behaviour depending upon the chemistry and morphology of the TPE. Different rheological behaviour does not prevent a given TPE from being processed, but it does dictate the general extents and conditions of the processing window for the TPE. So a good overview understanding of TPE rheology and processing capabilities is in order. Rheological behaviour exhibited during polymer flow will approach one of the two limiting behaviours shown in Figure 11 after Kear (a.18). A Newtonian fluid maintains a constant viscosity when the shear rate is increased. A Power Law fluid has a decreasing viscosity when the shear rate is increased. Many typical thermoplastics transition from one behaviour to the other as the shear rate is increased. For the Power Law fluid the slope of the line on a log plot of viscosity versus shear rate is equal to 1-n, where n is the Power Law exponent. The magnitude of the viscosity will dictate the pressure required to get flow at a given rate. Some TPEs have a higher overall viscosity and exhibit Power Law behaviour, so that at very low shear the effective strength of the TPE melt is quite high. Other TPEs have a transition to Newtonian behaviour at very low rates like many typical thermoplastic polymers. This Newtonian behaviour allows the TPE melt to flow and deform easily at low shear rate. It is a good characteristic for injection moulding especially when combined with an overall low viscosity behaviour.

The rheological behaviour for several TPEs is compared in Figure 12. The TPEs have differing flow behaviour. The SEBS shown is for an injection moulding grade which has a much lower overall viscosity which makes it flow better when filling an injection mould. The TPU and COPE have power law behaviour with some
tendency to approach Newtonian behaviour at low shear rates. The EPDM/PP TPV has strictly power law behaviour even to extremely low shear rates, and the slope is much higher showing it has sharply reduced viscosity at high shear rates yet has high viscosity at low rates. This high shear sensitivity gives this general purpose TPV a wide range of processability.

The preferred viscosity versus operational shear rate window for the three principal polymer processes, injection moulding, extrusion and blow moulding is shown in Figure 13. By comparing the preferred viscosities for the process shear rate windows to the viscosities of the TPEs in Figure 12 several things can be inferred about processability.
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For example, the SEBS moulding grade is highly tuned to the injection moulding process. The very low nearly Newtonian rheological behaviour makes the SEBS grade shown inappropriate for use in extrusion or blow moulding. This flow behaviour is like that for many thermoplastic polymers where the flow becomes Newtonian at low rates. COPE and TPU fit the extrusion window and lower end of the blow moulding and high end of the injection moulding range for these grades. The general purpose EPDM/PP TPV grades shown fit well in each of the preferred process windows indicating that this grade would have good rheological characteristics for each of these main processes. Further discussion and references are covered by Kear (a.18).

### 6.2 Comparison with Thermoset Rubber Processing

Traditional thermoset rubber components are made in a process that must include a shape forming process followed by the vulcanisation step where the formed rubber is held at high temperature for a period of time to allow the crosslinking reaction to occur. The principal processes used for thermoset rubber are extrusion and moulding. Extrusion is done in one of two main ways. One is where the rubber is extruded to shape and collected then vulcanised in a second batch process, for example in a steam autoclave. Another method is that the extrusion is done and vulcanisation follows sequentially in-line using some high temperature medium. The high temperature media used include molten salt bath, microwave radiation, hot air oven, a fluidised sand medium bed, or lead coating conveyed through an oven or autoclave.

Moulding is done by compression moulding an extruded preform, transfer moulding or by injection moulding. Each requires that the rubber be held in the mould for an extended period of time to allow the rubber to cure to the final vulcanised state. Compression moulding is generally done with a very large number of cavities which are processed in a batch. The economies of this process are driven by the very large number of cavities and an operator covering multiple moulds to achieve productivity. Transfer moulding is conducted in a press where material is squeezed from a transfer pot into a large number of cavities and held under pressure until vulcanisation is complete. Due to the partial preheating during the warm up in the transfer pot, moulding cycle times are typically somewhat shorter than for compression moulding. Injection moulding is carried out in a similar way to thermoplastic moulding. The rubber is extruded and injected into the mould cavity, and heated to vulcanisation temperatures during the injection phase. There are a smaller number of cavities in a typical rubber injection moulding process, but due to the process heating the vulcanisation time is shortened compared to compression moulding. All these moulding processes make parts with extensive flash and a separate deflashing process is typically carried out in a cryogenic tumbler.

![Preferred viscosity and shear rate range for polymer processes from Kear (a.18)](Reproduced with permission from the Society of Plastics Engineers)
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The TPE processes contrast to these traditional rubber vulcanisation processes in several key ways that provide economic, quality and consistency advantages. Figure 14 shows a diagram of the TPE part fabrication process compared to the thermoset rubber part fabrication process. Economic advantages come from the reduced cycle time because the TPE requires melting, shaping and cooling versus the longer time required for thermoset rubbers to be mixed, shaped and vulcanised. Another advantage for TPE is the highly automated processing that is possible.

Generally the TPE has higher capital costs, but these are justified because of the lower costs realised. Another economic advantage for TPEs is that they are recyclable. When scrap or off dimension parts are made they can be recycled. For thermoset fabrication processes the scrap can typically be 10 to 50%. The ability to be recycled gives TPEs the economic edge over thermoset rubber: TPE parts after the end of device life can be recovered and recycled. This benefit offers an ecological advantage and an important new benefit for society. The TPE fabrication processes have advantages making them very attractive options for fabricating elastomer components.

6.3 TPE Fabrication Processes

The main fabrication processes employed for rigid thermoplastic are applicable to TPEs with virtually no accommodation, i.e., extrusion, injection moulding and blow moulding.

6.3.1 Injection Moulding

TPEs injection mould in all the variations used: single material, insert moulding, multishot moulding, co-moulding which works in only a few specific situations, and gas or liquid assist injection to obtain a hollowed out part. Injection moulding of TPEs in general is carried out in the same manner as for rigid thermoplastics. The Power Law fluid behaviour of TPVs requires that they be injected quickly to obtain a low viscosity and achieve a low injection pressure. Specific injection moulding grades of SBC, TPO and TPVs are available to make moulding of thinner and longer parts easier with better appearance and consistency. Recent TPE developments include grades developed for achieving a bond to nylon, ABS (155), polycarbonate, PET, PBT, and even metals using an insert moulding or dual shot process.
Most of the TPEs can be injection moulded and use conventional thermoplastic processing equipment. The barrel is sized to have 3 to 5 shots to give only a modest heat history for the material and enough time to allow for uniform heating and shearing of the TPE. The injection moulding machine tonnage is generally sized for 40 to 70 MPa (3 to 5 tons/in²) clamping pressure to ensure that parts will not flash when filling the mould. Specific machine parameters will vary by TPE type and are driven by the rheological behaviour and the sharpness of the melt temperature range. Table 3 summarises some typical injection moulding conditions for several types of TPE. The process temperatures are typically adjusted to the melt temperature range and kept low enough to allow a short cooling time. Cycle time is kept as short as possible by keeping the mould temperature and melt temperature as cool as possible. When temperatures become too low the surface appearance and mechanical properties of the moulded component will be compromised. For some components with thin walls or a long flow distance the melt temperature will be kept higher to achieve complete filling of the mould and avoid problems with poor knit line strength or lack of fill. For the soft TPE grades the ejector pins are sized generously to avoid punching through the part during the ejection. To assist with TPE mould design a conventional thermoplastic mould filling analysis is often run to optimise the gate location, runner sizes and determine preferred operating conditions. The material suppliers commonly have characterised the physical constants necessary for the mould filling analysis using the commercial software available.

Most of the TPEs can be run fully automated in hot runner tooling which allows moulding without a runner that must be degated (140). For cold runner designs a three plate tooling design will allow for automatic degating of the parts if appropriately designed gates are used. Typically even soft TPEs will automatically degate with a tapering tunnel gate. These capabilities lend the TPEs to fully automated operation and improve the economics of component fabrication.

A number of the TPE suppliers have introduced new moulding grades during the last 5 years that have easier moulding, better surface appearance and bondability to a variety of substrates (91, 139, 212). EPDM/PP TPV rubber bonding grades have also been introduced to allow for insert moulding EPDM rubber pieces and welding them together to form a continuous picture frame sealing system with extruded thermoset rubber pieces. Two shot moulding with TPEs has become a very important commercial process in the last 5 years (209, 222). Many parts have been designed which use a rigid substrate that is overmoulded with a TPE using a two shot process (49). TPE processing temperatures are very similar to normal, but may be slightly elevated to ensure heat retention for developing a strong bond to the substrate. When developing a two shot process there are a number of details to cover in the tool design, machine selection and tooling shutoff design to avoid flash of the TPE during the second overmoulding step.

6.3.2 Extrusion

The extrusion process is widely applied to nearly all the TPEs. The conventional extrusion processes apply quite well to TPEs: profile extrusion (seals, tubing, etc.), sheet extrusion, cross-head extrusion for coating and jackets of hose and wire, coextrusion, and also foam extrusion. Typical extrusion process temperature profiles of several TPEs are shown in Table 4.
Profile extrusion is applied to processing to make a wide range of components including weatherseals, tubing, and rub strips. Coextrusion with multiple extruders feeding into the die assembly is used for multiple hardnesses, barrier material, recycled material incorporation and multiple coloured components.

The foaming extrusion process is used to make TPE components that compete with sponge rubber. The foaming process uses either a chemical foaming agent added to the TPE or a mechanical foaming agent. The CO₂ generating azodicarbonamides are popular for generating foamed TPEs with a good density reduction. Hydrocerol® (214) has become a key chemical foaming agent for TPVs, TPOs, and other TPEs due to its ability to form fine foam structures with a very good density reduction. Some new technologies have been developed to use water as an environmentally friendly mechanical foaming agent. Mechanical water foaming is capable of generating a very low density foam structure. The various processes have been evaluated and are found to be suited to OEM automotive weatherseal requirements (104, 201). Surface smoothness has to be addressed through tooling, coextrusion or some other approach for mechanical water foaming. In addition to injecting water directly into the extruder as the mechanical foaming agent, new technologies have been developed that use water containing or water generating agents to accomplish a similar result and have some advantages such as simpler processing and smoother surfaces.

A new interesting extrusion development is the robotic extrusion of TPVs as reported by Peterson and van Meesche (168). A robot arm with a heated braided pipe from the end of a small extruder is used to guide a TPV melt onto a surface, particularly glass, for architectural and automotive applications. The robotic extrusion has a die with the desired seal profile to locate a rubber seal in precisely the location desired. The TPV cools in place without any applied pressure and develops a welded bond to the substrate. Special TPV grades have been developed to work with this interesting new process technology.

### 6.3.3 Blow Moulding

A third major thermoplastic process, blow moulding, is amenable to use by many TPEs for hollow elastomer components. There are several variations of the blow moulding process. Two fundamental variations are extrusion blow moulding and injection blow moulding. There are TPE grades from nearly every class of TPE that will process by blow moulding. The simplest process is continuous extrusion blow moulding where a molten TPE parison is continuously extruded until long enough. Then the blow mould closes onto the parison and air pressure inflates it to form it to the shape of the mould cavity. As the parison is extruding the TPE must have sufficient melt strength to avoid drooping and thinning out prior to the mould close. Typical process conditions for extrusion blow moulding of several different TPEs are shown in Table 5. In addition to a continuous parison extrusion, there are a few variations of this extrusion blow process that work well with TPEs. One is the accumulator extrusion blow where the melt fills a chamber that is hydraulically emptied quickly to drop a parison very rapidly. This accumulator extrusion blow process minimises the difficulty of parison sag by dropping the parison quickly and closing the mould immediately. The other variation is a press blow
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extrusion blow moulding process where a moving die unit captures the end of the parison and slowly drops with the parison to support it and prevent the TPE from sagging excessively. In addition the die unit can have some specific geometry that is filled and provides inside detail on the end of the component. This is particularly useful for boots and bellows where a sealing bead or rib detail is desired on the inside of the component. The extrusion blow process is used for blow moulding COPE, TPU, TPV and other TPEs into boots, bellows and other hollow components.

Some of the newer developments in extrusion blow moulding include the use of programmed dual extrusion with dual hardness TPEs. This is commercially practiced with TPV and TPO. A variant of extrusion blow is three-dimensional blow moulding where the parison is extruded and laid into a three-dimensional shaped cavity before the mould is closed and the parison blown to shape. Machine manufacturers have two approaches to doing this. In one case the extrusion head moves over the cavity. In another the mould moves three-dimensionally underneath the blow moulding die to lay the parison into the cavity.

Some relatively complex components are made using the extrusion blow moulding process where inserts are put into the cavity prior to dropping the parison. It helps if the insert is compatible for bonding to the TPE. For example, putting a polypropylene fitting insert with an EPDM/PP TPV blow moulded bellows. Threaded knurled inserts have been included using a mechanical lock so that these threads can be used for fastening a component subsequently to a semi-rigid TPE blow moulded duct.

The second major type of blow moulding commonly used for TPEs is injection blow. The process commonly used is to form a parison preform that is captured on a core that rotates in the machine to a cavity mould, where it is inflated while still at the melt temperature and then cooled in the final component shape. Following the inflation station there is an ejection station where the final part is ejected or blown off. On some machines there is even a fourth station to allow temperature conditioning of the core before it rotates to the parison preform moulding station again. This injection blow process is also used extensively for COPE, TPV and other TPEs. The variation of injection blow moulding where a preform is moulded and cooled to a solid part in a separate operation, such as that used for PET bottles, is not as commonly used in TPEs. The advantage of stretch orientation hardening is not obtained with TPEs as it is for PET, so there is not as much driving force to use the process. The process will work for TPVs and other TPEs. It is not as common since the tooling costs for the multiple blow cavities require a large production volume. There are not many applications requiring extremely high volume engineered TPE components, unlike the market for bottle blowing for packaging.

### 6.3.4 Thermoforming

The thermoforming process is used for moulding TPEs. Sheet material can be drawn with vacuum or pressure to fill a thermoform cavity with many of the TPEs. There are not a lot of commercial applications to cite that have been able to take advantage of this lower cost tooling process. TPE sheet stock is easily obtained commercially and can be formed into the final shape for small volume production needs where a shell shaped TPE component is needed.
Recent developments in TPO processing characteristics have resulted in grades that are thermoformable and could be a competitive process for preparing automotive fascia and interior trim panels. The use of TPO panels has also allowed the development of fully recyclable panels (42).

6.3.5 Secondary Processes

There are a variety of secondary fabrication operations commonly used with many rigid thermoplastics that work quite well with TPEs with the appropriate operating window. For example, parts can be fastened together by all the major techniques: adhesion, heat welding, riveting, heat staking, ultrasonic welding, double-sided tape and even simple screws or christmas tree fasteners (52, 202, 213, 216). These assembly fabrication techniques supplement the more exotic two shot and insert moulding processes which have a higher volume production requirement to justify the capital investment. When selecting an adhesive the vendor should be consulted to select a compatible adhesive for the two materials that are to be bonded to each other. Wide varieties of adhesive systems work with TPEs and are used commercially. The cyanoacrylates, two part urethane, two part epoxy systems, solvent based adhesives and aqueous adhesives are widely used. For the very non-polar TPEs, including EPDM/PP TPV, TPO and IIR/PP TPV, a primer is sometimes required to activate the surface of the TPE so that the more polar adhesive will wet and bond to the TPE surface (250). There are adhesives that are available that will bond directly to these non-polar TPEs. There are also new bonding TPVs and the polar TPEs that achieve a bond directly without the use of a primer. In some instances the bonding TPE grades, e.g., bonding TPVs, will bond directly to substrates with just the application of heat and pressure.

Other fabrication processes that are used successfully with TPEs include: painting (170), hot stamping, in-line inking, on-line cutting, fabric braiding, tape adhesion, foam tapes and decorating techniques (46, 161, 174, 208, 251, 352). TPEs in general lend themselves to relatively easy adaptation of the technology used for rigid thermoplastics.

7 Thermoplastic Elastomers Markets and Applications

7.1 TPE Markets

The ubiquity of TPEs has become evident during the last few years (27, 36, 87, 99, 123, 134, 227). There are very few markets and industries that do not have some TPE applications. A list of markets that have TPE applications is shown in Table 6. The list of markets covers basically the cross-section of global industrial production.

There is one market area that surprisingly has not been penetrated to any substantial degree, and that is the automotive and truck tyre. It is the largest single market for thermoset rubber and would be an obvious target for any new material like TPEs. However, due to the highly engineered nature, complex processing and cost requirements the current TPEs are not used in any significant way in pneumatic tyres for automotive, truck, etc. Some solid tyres have used reaction injection moulding (RIM) TPU technology. But the penetration of TPEs into the solid tyre area is pretty limited largely due to the long cooling times required of very thick wall parts, which makes TPE processing uncompetitive with RIM.

Two primary concepts may drive the use of TPEs in a given market application. The first is the elastomeric performance characteristics of the TPE. These were discussed at some length earlier. The second concept is using the properties of a TPE to modify another material, using it as an additive. The performance attributes that give suitable characteristics for this driver are more difficult to quantitatively explain within this review. But in general the TPE must be chemically compatible or modified to have technological compatibility. The TPE must offer an

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<th>Table 6 Markets for TPEs</th>
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<td>Automotive</td>
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<td>Polymer modifiers</td>
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improved attribute in the modified material. For instance, this could be improved tackiness, adhesion, toughness, strength, tear resistance, ageing, heat resistance, etc. TPEs are added to other materials for these and other purposes to obtain a final modified material which has an improved overall characteristic or performance. One area of commercial interest includes using SBC as an additive in asphalt. The overall strength, elasticity and durability of the asphalt are improved. SBCs are also included in adhesive formulations for their tack, strength and adhesive properties (351).

TPEs are also alloyed with other polymers for improving the toughness, melt extensibility and processability. The new developments in polyolefins made by constrained site catalyst technology, e.g., metallocenes, have provided the ability to tailor molecular structure to a more precise degree. Primary examples are the α-olefin/ethylene copolymers, called polyolefin plastomers (POPs) when they have high ethylene. The low ethylene plastomers are called polyolefin elastomers (POEs). Both can very generically be seen as compatible with many other non-polar polymer systems and will provide toughness, strength, elasticity, processability, etc. In this early stage of POP and POE the costs are notably higher than conventional technology olefin materials, e.g., PP copolymers, rTPOs and PEs. They bring a value that offsets the costs. As the pricing structures change with increased production and grade availability the areas where they are suited as a polymer modifier will likely expand considerably. A variety of applications for POEs are being pursued (389, a.20) including automotive for interior trim and exterior parts, packaging, personal care, wire and cable, film, toys, sporting goods, sheeting, footwear, soft touch overmoulding, foam, extruded profiles and tubing. One noted area for the potential use of POPs and POEs is as a modifier in other TPEs, especially in systems that are already non-polar such as TPOs, TPVs, SEBS, some TPUs, some COPEs, etc. Often the part fabricator will not be aware that a TPE has been used to alloy or blend with the polymer they are using. But they will note that they have an improved polymer grade that has some aspect of higher performance that warrants its use. Weaver, Vercuski and Waszeciak (a.19) discussed the use of metallocene ethylene/octene and ethylene/α-olefin elastomers for modifiers in hard TPOs. Soft TPOs are achieved using the metallocene ethylene elastomer additive with improved resilience, low temperature and kink resistance. So users and specifying engineers may not be fully aware of the technology being employed in TPE blends to achieve better performance.

Another market concept growing for TPEs is their use as a concentrate for preparation of custom TPE formulations. These TPE concentrates may be used captively or commercially distributed as custom compounded TPE grades. This trend appears to be growing and will be an important TPE market. SBCs have been distributed in this manner for many years.

7.2 TPE Applications

TPEs are used in elastomer components across a very wide range. A partial list of these would include those shown in Table 7. While the list appears large it is a highly abridged listing of the applications for TPEs. An exhaustive list would be quite difficult to assemble because the industry has become quite large and is further complicated by the continuing rapid growth. But the list will serve as some good examples of areas to consider for applying TPEs.

The performance and property attributes that are needed in TPE applications and the properties of different types of TPEs are summarised in Table 8. For many of the TPEs certain grades will have the attributes. For example, many SEBS grades may not be flame retardant, but some grades will have this attribute. These attributes of the various TPEs will be reasons that one TPE might have a preference in a given application and market. As can be seen there is a lot of commonality in general performance requirements that will lead to the consideration of several TPEs as possible candidate materials for applications. Specific chemistry, performance and application specifications will be factors that are used to decide which type of TPE and which grades will be the ones to focus on for developing an application.

The common applications for the various TPEs will be a good guide to understand which ones to consider in new applications under development. The list shown in Table 9 is a partial list summarising applications broken down by TPE type. Often several of the attributes above will be important factors in the commercial success of the TPE in that application. A detailed study of any given application’s performance requirements versus the attribute list and other physical and chemical properties will be needed for adopting a TPE in a similar or equivalent application. Specific grade variations and performance requirements must be evaluated carefully before deciding to use the TPE in a new application in development. Laboratory test data and field
performance tests are generally recognised as necessary steps to prove the suitability of the TPE for an application. The list shown here can be used as a guide but cannot be a short cut to avoid this normal development process.

The list shown in Table 9 demonstrates how ubiquitous TPEs have become. Each TPE has some applications where it is a strong candidate material. The suppliers of the TPEs often have specific grades of material that are more optimal for some applications. They should be consulted to determine which candidates would be better to consider for applications under consideration. A key point to realise is that the number of grades and types of TPEs continues to expand and new candidate TPE products may become available that should be considered. This proliferation of enhanced TPE grades is pronounced enough that often some lower cost candidate TPEs have become available which blur the line between which TPE materials are more suited to a given application. Also new TPEs with increased performance capabilities are being introduced that will displace a thermoset elastomer that may have been a preferred candidate previously for an application.

### 8 Conclusion

In summary, one should conclude that there are a large number of new developments in the TPE industry. There are new TPE types with the entry of the metallocene POPs and POEs, high temperature TPSiV, high temperature AEM TPV, a new series of SBCs with improved mouldability, low hygroscopicity TPVs, bonding grades of TPVs, new moulding and extrusion TPU grades and a soft COPE TPV grade to cite a few. The number of suppliers in the industry continues to grow and some are consolidating efforts. New applications have been developed, for example TPV weatherseals. The new process developments for TPE are part of the industry growth as well. Two shot moulding has become a standard for many grips, appliances, automotive components and more. Foamed TPVs by water foaming and similar approaches are offering new weatherseal technology options based on TPEs. Robotic extrusion of TPEs over substrates has been developed for edge seals.

There are a number of directional trends ongoing in TPEs. New alloy TPE products are being developed and the pace of new product introductions is gathering speed. The trend is to make ever softer TPEs.
<table>
<thead>
<tr>
<th>Property</th>
<th>SBS</th>
<th>SEBS</th>
<th>TPO</th>
<th>EPDM/PP TPV</th>
<th>TPU</th>
<th>COPE</th>
<th>MPR</th>
<th>COPA</th>
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<tr>
<td>Sealing</td>
<td>G</td>
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<td>High recovery at 23 °C</td>
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<td>Low set at high temperature</td>
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<td>G</td>
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<td>F</td>
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<td>Low density/lightweight</td>
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<td>Clarity</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>F</td>
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<td>Tacky surface</td>
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<td>Dry surface</td>
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<td>High electrical resistance</td>
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<td>Flame retardant</td>
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<td>High stretch</td>
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<td>High strength</td>
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<td>Microwave usable</td>
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<td>Foam extrusion</td>
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<td>Low temperature flexibility</td>
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<td>Dynamic flexing applications</td>
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<td>Static applications</td>
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<td>Polymer modification</td>
<td>G</td>
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<td>S</td>
<td>S</td>
<td>G</td>
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</tbody>
</table>

G = generally has
F = some families
S = specific grade
<table>
<thead>
<tr>
<th>TPE</th>
<th>Type</th>
<th>Applications</th>
</tr>
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<tbody>
<tr>
<td>SBS</td>
<td>Styrene-butadiene-styrene block copolymer</td>
<td>Hot melt adhesive, pressure sensitive adhesives, asphalt modifier, polymer modifier, shoe sole, houseware grips, toothbrush handles, cosmetics, sporting goods</td>
</tr>
<tr>
<td>SEBS</td>
<td>Styrene-ethylene-butylene-styrene block copolymer</td>
<td>Electrical connector, wire insulation, air bag covers, auto interior and exterior trim, gaskets, tool grips, ladder feet, pen grips, hot melt adhesive, pressure sensitive adhesives</td>
</tr>
<tr>
<td>TPO</td>
<td>Thermoplastic olefin</td>
<td>Auto bumper, auto trim panels, interior auto trim, electrical wire jacketing, suspension boots, feet, bumpers, soft touch tools, sporting goods, caster wheels</td>
</tr>
<tr>
<td>EPDM/PP TPV</td>
<td>EPDM rubber and polypropylene thermoplastic vulcanisate</td>
<td>Underhood auto seals, auto weatherseals, foamed seals, suspension boots, steering gear boots, drive axle boots, suspension bushing, medical seals, appliance seals, houseware grips, expansion joints, architectural weatherseals, appliance feet, bumpers, rub strips, soft grip tools, caster wheels, ignition seals, wire insulation and jacketing</td>
</tr>
<tr>
<td>MPR</td>
<td>Melt processable rubber</td>
<td>Fuel filler guard, gasoline cap seal, auto grommets, bearing seals, pipe couplings, latches, irrigation seals, safety goggles, fuel primer bulbs, tool grips, wire insulation, auto weatherstrip</td>
</tr>
<tr>
<td>TPU</td>
<td>Thermoplastic urethane block copolymer</td>
<td>Adhesives, hot melts, breathable films and fabric, coated fabric, auto trim, medical gown, medical gloves, auto ball joint seals, hydraulic hose covers, spiral hose, electrical wire jacketing, drive axle boots, gaskets, seals, belts, animal identification tags, tool grips, caster wheels, ski boots, shoe soles, sport shoe cleats, corrugated tubing, cable connectors, cable covers, tubing, film and sheet, dust cover, bellows</td>
</tr>
<tr>
<td>COPE</td>
<td>Copolyester block copolymer</td>
<td>Auto drive axle boots, coiled cord jacketing, torque couplings, door latch bumpers, high temperature seals, gears, pump diaphragms, tubing, steering gear bellows, oil and gas cap seals, hinges, electrical connectors, air brake tubing, sound deadening housing, sporting goods, rail pads</td>
</tr>
<tr>
<td>COPA</td>
<td>Copolyamide block copolymer</td>
<td>Hot melt adhesives, polymer modifier, breathable films, sport equipment, footwear, soft touch keys, auto glass seal, grips, tubing, belts</td>
</tr>
<tr>
<td>POE</td>
<td>Polyolefin elastomer (metallocene polymer)</td>
<td>Footwear, film, sheeting, wire and cable, automotive interior trim, automotive exterior parts, packaging, soft touch overmoulding, toys, sporting goods, personal care, polymer modification, foam, extruded profiles, tubing</td>
</tr>
<tr>
<td>POP</td>
<td>Polyolefin plastomer (metallocene polymer)</td>
<td>Polymer modification, film, fibres, packaging, seals and gaskets</td>
</tr>
<tr>
<td>AEM TPV</td>
<td>Ethylene-acrylate rubber thermoplastic vulcanisate</td>
<td>Auto underbonnet: electrical connectors, hose covers, air ducts, high temperature CVJ boots, drive train shaft seals</td>
</tr>
<tr>
<td>TPSiV</td>
<td>Silicone rubber thermoplastic vulcanisate</td>
<td>High temperature seals and gaskets, industrial hose, grips, industrial tubing, auto underbonnet, silky touch sports, leisure and furniture, brake line cover, fuel line cover, construction profile</td>
</tr>
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</table>
Bondability with an emphasis on overmoulding is being driven by the increasing interest in and application of soft touch to many components. The new constrained site catalysts have allowed the development of improved olefin polymers. Examples of these include the new grades of POE, POP and ePP polymers. Another important trend has been to attain higher use temperatures, greater fluid resistance and low hardness TPEs. The future developments could be expected to extend the range of TPE products available.

**Additional References**

a.15 M. Soliman, M. van Es and M. van Dijk, PMSE, ACS Prepr., 1998, 79, 86.

**Abbreviations and Acronyms**

ABS acrylonitrile-butadiene-styrene terpolymer  
ACM acrylate rubber  
AEM ethylene-acrylate rubber  
AFM atomic force microscopy  
ASA acrylonitrile-styrene-acrylate  
BR butadiene rubber  
COPA copolyamide  
COPE copolyether-ester or copolyester-ester  
CR polychloroprene, also known as neoprene  
CSM chlorosulfonated polyethylene rubber  
ECO epichlorohydrin rubber  
EP ethylene-propylene copolymer  
EPDM ethylene-propylene-diene terpolymer  
ETPV engineering thermoplastic vulcanisate  
FEA finite element analysis  
FKM fluoroelastomer  
FTIR Fourier Transform Infrared Spectroscopy
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>FVMQ</td>
<td>fluorinated silicone rubber</td>
</tr>
<tr>
<td>HNBR</td>
<td>hydrogenated nitrile rubber</td>
</tr>
<tr>
<td>IIR</td>
<td>isobutylene-isoprene rubber</td>
</tr>
<tr>
<td>IR</td>
<td>infrared</td>
</tr>
<tr>
<td>MDI</td>
<td>methylene diphenyl 4,4′-diisocyanate</td>
</tr>
<tr>
<td>MPR</td>
<td>melt processable rubber</td>
</tr>
<tr>
<td>NBR</td>
<td>nitrile rubber</td>
</tr>
<tr>
<td>PA</td>
<td>polyamide</td>
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<tr>
<td>PBT</td>
<td>polybutylene terephthalate</td>
</tr>
<tr>
<td>PEG</td>
<td>polyethylene glycol</td>
</tr>
<tr>
<td>PET</td>
<td>polyethylene terephthalate</td>
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<tr>
<td>POE</td>
<td>polyolefin elastomer</td>
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<tr>
<td>POP</td>
<td>polyolefin plastomer</td>
</tr>
<tr>
<td>PTMEG</td>
<td>polytetramethylene glycol</td>
</tr>
<tr>
<td>PVC</td>
<td>polyvinyl chloride</td>
</tr>
<tr>
<td>RIM</td>
<td>reaction injection moulding</td>
</tr>
<tr>
<td>rTPO</td>
<td>reactor thermoplastic olefin</td>
</tr>
<tr>
<td>SBC</td>
<td>styrene block copolymer</td>
</tr>
<tr>
<td>SBS</td>
<td>polystyrene-polybutadiene-polystyrene</td>
</tr>
<tr>
<td>SEBS</td>
<td>polystyrene-poly(ethylene-butylene)-polystyrene</td>
</tr>
<tr>
<td>SEM</td>
<td>scanning electron microscopy</td>
</tr>
<tr>
<td>SIS</td>
<td>polystyrene-polyisoprene-polystyrene</td>
</tr>
<tr>
<td>TEM</td>
<td>transmission electron microscopy</td>
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<td>TPE</td>
<td>thermoplastic elastomer</td>
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<td>TPO</td>
<td>thermoplastic olefin</td>
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<tr>
<td>TPU</td>
<td>thermoplastic polyurethane</td>
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<td>TPV</td>
<td>thermoplastic vulcanisate</td>
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<tr>
<td>T</td>
<td>polysulfide rubber</td>
</tr>
<tr>
<td>TTS</td>
<td>time-temperature superposition</td>
</tr>
<tr>
<td>VMQ</td>
<td>silicone rubber</td>
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Abstracts from the Polymer Library Database

Item 1
Injection Molding
11, No.8, July 2003, p.36
MATERIALS UPDATE - ULTRASOFT TPE’S
MARCH FORWARD
Maniscalco M

Highlighted in this article is new “Versaflex CL2003”, a clear, injection mouldable, gel-like thermoplastic elastomer (TPE) with a 30 Shore 00 hardness - which leads the way for a new class of ultrasoft grades. The TPE has been made by GLS Corp., a soft-touch TPE compound supplier, to meet the needs of applications such as gel bicycle seats, shoe sole inserts, furniture arm rests, and grips for personal care products. Full details are provided.

GLS CORP.; PITTSBURGH PLASTICS MANUFACTURING INC.; CUSTOM CONTRACT MFG.
USA; WORLD
Accession no.895604

Item 4
MORPHOLOGICAL, RHEOLOGICAL AND MECHANICAL CHARACTERIZATION OF POLYLACTIDE-B-POLYISOPRENE-B-POLYLACTIDE TRIBLOCK COPOLYMERS: NEW PARTIALLY BIODEGRADABLE THERMOPLASTIC ELASTOMERS
Frick E M; Hillmyer M A
Minnesota,University (ACS,Div.of Polymeric Materials Science & Engng.)
Results of the above characterisation, carried out for three representative triblock copolymers differing in morphology (spheres, cylinders and lamellar), are presented and discussed. Data are given on molec.wt., polydispersity, Tg and stress-strain properties. 14 refs.
USA
Accession no.895421

Item 5
China Synthetic Rubber Industry
26, No.4, 2003, p.216-20
Chinese
STRUCTURE AND PROPERTY OF IIR/PP THERMOPLASTIC VULCANIZATES. I. EFFECT OF SOFTENING AGENT AND FILLER ON STRUCTURE AND PROPERTY OF IIR/PP TPV
Tian Hongchi; Liu Yuexing; Feng Yuxing; Wu Shemao; Zhang Liqun
Beijing,University of Chemical Technology
The structure and properties of butyl rubber(IIR)/PP thermoplastic vulcanisates(TPVs) with different contents of oil and silica were investigated, with particular reference to the rheological properties and elasticity. The morphology was studied by diluting the IIR/PP TPV using PP. The results showed that oil significantly improved the flow properties of the TPV, while silica had little effect on the mechanical properties. A mechanism for the effect of oil on the flow properties was proposed in which, during dynamic vulcanisation, the crushing efficiency of the rubber was enhanced by addition of softening agent. At
the same time, some oil migrated into the PP, so that the viscosity of the matrix decreased. 5 refs.

CHINA
Accession no.895385

Item 6
Popular Plastics and Packaging
48, No.8, Aug 2003, p.91-2
INJECTION MOULDING OF METALLOCENE POLYOLEFINS
Upadhyaya P
CIPET

New families of metallocene based polyolefin plastomers and elastomers are offering injection moulders broad new opportunities. This article covers processing conditions using flexible-PVC moulding as its primary reference. A significant cost advantage of POPs and POEs derives from their low density. A 40% difference in density compared with f-PVC translates into 40% more parts per kg of resin with POEs and POPs. Metallocene polyolefins have the capability to run on either a hot or a cold runner system. 4 refs.

INDIA
Accession no.894400

Item 7
Plastics News International
Aug.2003, p.10/2
UNDER-THE-HOOD TVPS RELEASED
Zeon Chemicals’ thermoplastic vulcanisates combine the processing and favourable economics of engineering thermoplastics with the heat, oil resistance and flexibility of thermoset elastomers. The result is a family of materials that is ideal for underhood applications ranging from hoses, ducts, connectors and boots to dynamic seals. Zeon has completed a series of studies benchmarking Zeotherm polymers versus conventional materials used for flexible, low durometer applications, including PP-based TPVs, copolyester and melt-processable rubber. These studies evaluated the retention of physical properties after short term exposure to 150C and hot oil conditions that are common under-the-hood. Zeotherm TPVs were the only materials that survived hot oil exposure with minimal change in physical properties. Zeotherm TPVs are available in two grades, both of which are based on Zeon’s thermoset polyacrylate elastomer dynamically vulcanised in a polyamide matrix.

ZEON CHEMICALS
USA
Accession no.894314

Item 8
Brookfield, CT, SPE, 2003, p.185-191, 27 cm, 012

RHEOLOGY MODIFIED THERMOPLASTIC ELASTOMERS
Adur A; Harrell R; Haylock J
PolyOne Corp.
(SPE,South Texas Section; SPE,Theroplastic Materials & Foams Div.; SPE,Polymer Modifiers & Additives Div.)

Details are given of a new family of olefinic thermoplastic elastomers, developed by PolyOne. The viscoelastic properties of these resins have been modified in a reactive extrusion process to given them a combination of high melt strength and shear thinning characteristics, lacking in simple polymeric dispersions. These enhanced viscoelastic properties are claimed to make the resins particularly suitable for shape extrusion, blow moulding and foam applications. In addition, reactive extrusion of combinations of ethylene-octene elastomers with other elastomers such as EPDM, is shown to give a ‘design space’ for the production of thermoplastic elastomers with a significantly broader balance of compression set and hardness properties. 2 refs.

USA
Accession no.892541

Item 9
KGK:Kautschuk Gummi Kunststoffe
56, No.6, June 2003, p.300-1
German
AS YOU LIKE IT - VISUAL EFFECTS OF THERMOPLASTIC VULCANISED RUBBER
Maurel C; Laurent D
Advanced Elastomer Systems NV/SA

The first impression is the most important and is often the decisive factor about the success or failure of a product. Thermoplastic vulcanised rubber products of a type of Santoprene are offering product designers many opportunities to optimise haptic and visual properties for every sort of application. This article looks at how Santoprene, which is a fully vulcanised material on a polyolefin base, is now opening up a broad spectrum of possibilities. It discusses uses like handle grips for tools, e.g. hammers, as well as its softness to the touch, its variety of colours and special effects with its transparency. Others areas of application examined include domestic appliances, motor vehicle components, electronic appliances, furniture, packaging and toys. 4 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE
Accession no.892444

Item 10
Rubber and Plastics News
32, No.26, 28th July 2003, p.5

PHYSICIAN HEAL THYSELF
McNulty M

Sixteen years of research and development by French rubber goods maker Hutchinson has yielded the G-Vir
synthetic rubber glove which the company claims reduces infection by up to 60%. The antiviral glove can clean and disinfect wounds instantly if it is pierced. G-Vir features two external layers of styrene block copolymer thermoplastic elastomer with an intermediate layer containing an emulsified disinfecting agent. Droplets of the liquid agent are released into a wound if the glove is punctured by a dirty needle or other instrument. The droplets substantially reduce virus particles entering a wound, it is claimed.

HUTCHINSON SA
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.892370

Item 11
West Conshohocken, Pa., 2002, pp.4. NALOAN
ASTM D 6436. GUIDE FOR REPORTING PROPERTIES FOR PLASTICS AND THERMOPLASTIC ELASTOMERS
American Society for Testing & Materials
ASTM D 6436

Version 2002. Photocopies and loans of this document are not available from Rapra.
USA
Accession no.891044

Item 12
Plastiques & Elastomeres Magazine
French
THERMOPLASTIC ELASTOMERS FOR EXTERNAL USE
Berger G; Beitzel M
Kraiburg

Results are presented of studies of the resistance to light exposure of thermoplastic elastomers for use in external automotive applications, and of changes in colour and mechanical properties after exposure. The performance of two styrene-ethylene butylene-styrene block copolymers and an EPDM/PP blend was investigated.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.890178

Item 13
Plastiques & Elastomeres Magazine
French
MULTIBASE WANTS TO REVOLUTIONISE THERMOPLASTIC ELASTOMERS
Gouin F

An examination is made of the properties, processing and applications of the TPSiV range of dynamically vulcanisable thermoplastic elastomers consisting of silicone rubber dispersed in a thermoplastic continuous phase. Developed by Dow Corning, these materials are marketed by its subsidiary Multibase.
MULTIBASE SA; MULTIBASE INC.; METZERPLAS; DOW CORNING CORP.
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; ISRAEL; USA; WESTERN EUROPE
Accession no.890174

Item 14
Popular Plastics and Packaging
48, No.6, June 2003, p.13-4
TOUGH VINYL TPE HELPS SPORTS AND MUSIC PRODUCERS CREATE SPECTACULAR ENTERTAINMENT
A manufacturer specialising in cable for entertainment venues, Coast Wire & Plastics Technology, is using Flexalloy PVC-based thermoplastic elastomer from Teknor Apex to produce a new line of products that are lighter, more flexible and more resistant to extreme cold than cable produced with conventional compounds. Coast Wire is producing a new line of entertainment cable based on Flexalloy called FlexOLite. One big advantage of Flexalloy TPE for cable insulation and jacketing is that it weighs only half as much as rubber, enabling cable installers to increase overhead lighting.
COAST WIRE & PLASTIC TECHNOLOGY INC.; TEKNOR APEX CO.
USA
Accession no.889664

Item 15
Rubber World
228, No.2, May 2003, p.34/42
ENHANCING METALLOCENE TPE'S PERFORMANCE FOR EXTRUDED APPLICATIONS
Weaver L B; Heck H G; Moldovan D
DuPont Dow Elastomers

This article covers the general characteristics of Engage polyolefin elastomers and the breadth of technologies available to enhance certain physical and processing properties of the elastomers for extruded profile applications. Technologies shown include: designed polymer architecture in the reactor to achieve enhanced extrusion processing; post extrusion elastomer modification with electron beam crosslinking to enhance upper service temperature performance; and blends with PP and crosslinking agents like peroxide and coagent to meet the processing and performance requirements for extruded profile applications. 3 refs.
USA
Accession no.889630

Item 16
Polymer Science Series B
45, Nos.1-2, Jan.-Feb.2003, p.17-21
THERMOPLASTIC VULCANIZATES BASED ON A POST-CONSUMER POLYETHYLENE AND VARIOUS ELASTOMERS
Chepel L M; Kompaniets L V; Prut E V
Russian Academy of Sciences

The preparation of thermoplastic vulcanizates based on post-consumer LDPE and polyisoprene, butadiene-methylstyrene butadiene and ethylene-propylene-ethylidenenorbornene rubbers under various conditions is studied. The mechanical properties of the as formed compositions under tension (elastic modulus, ultimate strength and strain, stress at a tensile strain of 100%, residual strain) are characterised. As curing agents, sulphur-containing compounds are used. As a result of vulcanisation of a rubber phase upon its simultaneous blending with LDPE, the ultimate values of tensile strength and strain of the as-prepared blends are shown to substantially increase, with this increase being controlled by the formula of the curing system. Elastic modulus and stress at 100% tensile strain are found to be dependent of the type of rubber in the blend. As is shown, under certain conditions, it is possible to prepare thermoplastic vulcanizates based on the post-consumer LDPE which are characterised by an ultimate tensile strain of 300% and a residual strain of 15-30%. 12 refs.

USA
Accession no.888224

Item 18
Plastics News International
April 2003, p.16-7
TPV SPREAD ITS WINGS

Perhaps best known for its use in automotive seals and gaskets. Advanced Elastomer Systems’ Santoprene thermoplastic vulcanisate is finding favour in a wide range of other applications. Hewlett-Packard is using the product and an innovative lid design to add a touch of flair and functionality to one of its latest printer/scanner/copier/fax all-in-one products. The HP PSC 950 ‘all-in-one’ utilises the TPV to create a soft-touch grip... in the shape of an ellipse... on the product’s rigid plastic lid. The soft-touch component provides the all-in-one with enhanced aesthetics and a modern, sleek look. In addition the smooth, grippable surface provides the user with a distinct tactile experience when lifting and replacing the lid. Details are given of other applications making use of the material.

ADVANCED ELASTOMER SYSTEMS LP
USA
Accession no.888036

Item 19
KGK:Kautschuk Gummi Kunststoffe
56, No.5, May 2003, p.242-9
German
APPLIED TESTING OF TPES
Vennemann N
Osnabruck,University

The assessment of the possibilities and limits of TPEs is carried out based on characteristic quantities which are determined according to the standardised rubber test methods. These test methods are oriented towards the unique behaviour of common rubber materials, but may not be fully suited to detect the different behaviour of TPEs. The subject of this work is the presentation of new test methods that can contribute to a better characterisation of TPEs. Thus the mechanical and thermal-mechanical limits of TPEs can be estimated more precisely than before. 14 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.887340

Item 20
Popular Plastics and Packaging
48, No.5, May 2003, p.13
SPECIALIST IN ENTERTAINMENT CABLE
SAYS ADVANCED PVC COMPOUND

and processing. This level of adhesion to various metallics, combined with the lightweight, soft and flexible characteristics of TPVs, contributes to improved performance for applications such as sealing devices, grips and sound dampening panels. 6 refs.
OUTPERFORMS CONVENTIONAL VINYL IN COLD WEATHER

Rock concerts and sports events require an enormous amount of cable for lighting, sound, media and more. An advanced PVC-based thermoplastic elastomer from Teknor Apex has enabled a cable manufacturer specialising in such applications to help customers create more spectacular events by supplying them with cable that is lighter, more flexible and more resistant to extreme cold than cable produced with conventional compounds. One big advantage of Flexalloy vinyl TPE for insulation and jacketing is that it weighs only half as much as rubber.

TEKNOR APEX
USA
Accession no.887263

Item 21
Medical Device Technology
14, No.4, May 2003, p.38-40
THERMOPLASTIC ELASTOMERS IN MEDICAL APPLICATIONS
Radley H
Harvest Polymers Ltd.
Thermoplastic elastomers provide medical designers with a broad spectrum of soft-feel, hygienic materials that can readily fulfil accepted medical industry standards with the exception of body implants. The attraction of TPEs lies in the way they combine thermoplastic processing properties with the physical properties of vulcanised rubber. TPEs in general may be comoulded or coextruded with other thermoplastics, which is difficult with thermostet rubbers.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.886128

Item 22
Brookfield, CT, SPE, 2003, p.145-54, 27cm, 012
RECYCLED RUBBER BASED THERMOPLASTIC ELASTOMERS - AN UNUSUAL OPPORTUNITY TO CUT COST
Gonzalez E A
Eco-Tech Inc.
(SPE,Environmental Div.)
The environmental and health problems associated with scrap tyres are well known. Methods have long been sought to utilise these waste tyres in such a way that an optimum is obtained between as low as possible cost to produce on the one hand and technical applications of the highest possible quality on the other hand. This paper describes several applications where a recycled rubber based thermoplastic elastomer has replaced virgin thermostet rubber with a balance of performance, processability and value. It includes a discussion of performance properties required vs performance achieved and cost benefits. 6 refs.
USA
Accession no.886070

Item 23
Adhesives & Sealants Industry
10, No.3, April 2003, p.26-31
HYDROGENATED STYRENIC BLOCK COPOLYMER OFFERS BENEFITS FOR PSAS
De Keyzer N; Muyldermans X
Kraton Polymers Research SA
Kraton Polymers pioneered styrene block copolymer technology in the 1960s and has since been leading innovative developments in the field of SBCs. The focus of this article is on the potential of a novel hydrogenated Kraton polymer, called Kraton GRP-6924, for pressure sensitive adhesives in tapes and labels. Two SEBS grades developed for PSA applications have been used as comparative polymers against Kraton GRP-6924. Kraton GRP-6924 shows a good balance of adhesive properties, tack, adhesion, cohesion, service temperature and an attractive low hot melt viscosity. Low hot melt viscosity is achieved at about 35% rubber content. At higher rubber content, the viscosity increases as does the service temperature, but thanks to the higher stability of hydrogenated SEBS, the formulations can be processed also at more elevated temperatures, i.e., 190C. 6 refs.
BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE
Accession no.885272

Item 24
Polymer Engineering and Science
43, No.3, March 2003, p.531-42
MICROCELLULAR MODEL EVALUATION FOR THE DEFORMATION OF DYNAMICALLY Vulcanised EPDM/IPP BLENDS
Wright K J; Undukuri K; Lesser A J
Amherst,Massachusetts University
The origins of elasticity in thermoplastic vulcanisates have been debated for the past decade. Previous modelling attempts provide numerical solutions that make assessment of constituent concentration and interactions unclear. A microcellular modelling approach is proposed and evaluated to describe the steady-state behaviour of dynamically vulcanised blends of EPDM and isotactic PP (iPP). This approach provides an analytic result including terms for composition and cure-state. Three types of deformation are accounted for elastic and plastic deformation of iPP, elastic deformation of EPDM and localised elastic and plastic rotation about iPP junction points. The viability of the constitutive model is evaluated in terms of iPP concentration and EPDM cure-state. 18 refs.
USA
Accession no.884488
Item 25

**Plastics Engineering**
59, No.3, March 2003, p.16

ELASTOMER AIR DUCTS WITHSTAND ARCTIC BLASTS

Playing a key role in feeding air to the engine in Arctic Cat snowmobiles, connecting ducts made of DuPont Hytrel thermoplastic polyester elastomer accommodate shock and vibration, even at temperatures as low as -40 deg.C, DuPont reports. Two flexible ducts blow moulded from Hytrel connect fixed air-handling elements of two 2003 Arctic Cat models, the 4 Stroke Touring and the Bearcat. One duct links an air-gathering part mounted beneath the snowmobile’s hood to a noise-reducing air box mounted on the engine block. The other conveys air from the air box to the engine’s intake manifold. According to Arctic Cat, Hytrel meets this application’s needs for flexibility, flex endurance and impact resistance over a wide temperature range. It also meets key requirements for resistance to fuel, oil, and ozone. Details are given.

DU PONT DE NEMOURS E.I.,& CO.INC.
USA

Accession no.884351

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Item 26

**KGK:Kautschuk Gummi Kunststoffe**
56, No.3, March 2003, p.114-22

German

OIL RESISTANT THERMOPLASTIC ELASTOMERS. 1. INFLUENCE OF THE RAW POLYMER SELECTION ON OIL RESISTANCE AND MECHANICAL PROPERTIES OF PP-TPE-V

Blume M; Schuster R H

DIK

Tests were carried out on thermoplastic vulcanisates based on isotactic PP and polar rubbers ENR, EVA, HNBR, NBR, and ACM. Vulcanisates were prepared by dynamic vulcanisation in an internal mixer. The influence is examined of the raw material selection on the oil resistance and mechanical properties of the PP-thermoplastic elastomer vulcanisate, with reference to rubber ratios and the increasing polarity of the rubbers. 25 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.883472

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Item 27

**Popular Plastics and Packaging**
48, No.3, March 2003, p.32

ELASTOMER POLYMER GLOBAL MARKETS TO 2010

According to a report from Margolis Polymers, 1.5 million metric tons of thermoplastic elastomers and thermoplastic vulcanisates were consumed in North America in 2002. Synthetic rubber consumption was 3.2 million metric tons and NR compound consumption was 1.1 million metric tons. Elastomer Polymer Global Markets to 2010 is a detailed and comprehensive report on elastomer polymer growth markets, with market statistics and product development for TPV, TPE and SR, it is briefly reported.

MARGOLIS POLYMERS
WORLD

Accession no.881716

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Item 28

**Polymer International**
52, No.1, Jan.2003, p.120-5

RHEOLOGICAL AND MECHANICAL PROPERTIES OF DYNAMICALLY CURED POLY(VINYL CHLORIDE)/NITRILE BUTADIENE RUBBER THERMOPLASTIC ELASTOMERS

Moussa A; Ishiaku U S; Ishak Z A M

Jordan,Al-Balqa Applied University; Malaysia,Science University

Dynamic curing of PVC/nitrile butadiene rubber (NBR) thermoplastic elastomers introduced crosslinks into the NBR which improved the mechanical properties, as shown by the decrease in the swelling index and increase in torque. The changes in tensile properties, tear strength and hardness of the dynamically cured thermoplastic elastomers after thermooxidative ageing were indicative of post curing. 13 refs.

JORDAN; MALAYSIA

Accession no.881320

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Item 29

**Journal of Elastomers & Plastics**

STUDIES ON THE RHEOLOGY AND THE MECHANICAL PROPERTIES OF THERMOPLASTIC ELASTOMER FROM LATEX PRODUCT WASTE AND HIGH DENSITY POLYETHYLENE

Rajalekshmi S; Joseph R

Cochin,University of Science & Technology

Scrap latex products, e.g. glove waste and thread waste, containing high-quality rubber hydrocarbon that is only lightly cross-linked were modified into processable materials by a novel economic process using zinc oxide, stearic acid, mercaptobenzthiazole, naphthenic oil and hydroquinone. Thermoplastic elastomers were then prepared from the modified waste materials and high-density polyethylene (HDPE). Mechanical properties, rheology and morphology of the blends were compared with those of elastomers based on natural rubber-HDPE. Even after reprocessing, the blends retained mechanical properties to a great extent. 19 refs.

INDIA

Accession no.880494
Item 30
Rubber World
227, No.5, Feb.2003, p.40-3
SILICONE TPV OFFERS HIGH PERFORMANCE SOLUTIONS
Liao J; Shearer G; Gross C
Multibase
The development of a novel thermoplastic silicone vulcanisate, designated TPSiV, which combines the benefits of engineering thermoplastics and high performance silicone rubber, is reported and the key properties and end-use applications of four TPSiV products (1180-50D, 3010-50A, 3010-60A AND 3011-60A) are described. The suitability of these thermoplastic vulcanisates for overmoulding and comoulding is also demonstrated. 5 refs.
USA
Accession no.880113

Item 31
Journal of Materials Science
THERMAL, UV- AND SUNLIGHT AGEING OF THERMOPLASTIC ELASTOMERIC NATURAL RUBBER-POLYETHYLENE BLENDS
Bhowmick A K; White J R
Indian Institute of Technology; Newcastle-upon-Tyne, University
The results are reported of a study of the ageing of a new family of thermoplastic elastomers, which were based on blends of NR and polyethylene and uncrosslinked or cured using either dicumyl peroxide or a sulphur-based vulcanisation system. The blends were heat aged at 65, 80 and 90C, UV aged in a weatherometer and exposed to sunlight under different temperature and humidity conditions. The effects of ageing on the tensile and dynamic mechanical properties of the blends were examined and surfaces of aged samples analysed by scanning electron microscopy. The effects of several stabilisers (antioxidants and heat and light stabilisers) on ageing were also evaluated. 10 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; INDIA; UK; WESTERN EUROPE
Accession no.879476

Item 32
International Polymer Science and Technology
30, No.1, 2003, p.T/1-20
NEW CORROSION AND HEAT RESISTANT ELASTIC POLYMERIC MATERIALS FOR THE CHEMICAL INDUSTRY
Ronkin G M
Sintez Scientific Research Institute
This article reports on the chemical and heat resistance of newly developed materials for use in packing and sealing applications in aggressive conditions in the chemical industry. It is reported that new, highly effective, composite, corrosion- and heat-resistant packing and sealing and protective elastic polymeric materials of the BS-45 type have been developed which are capable of operating at temperatures ranging from -60 - +350 degrees C, and also heat resistant materials of the B-800 and B-850 type, which are capable of operating at temperatures ranging from -60 - +375 degrees C, to replace existing outdated analogues such as rubber, plastics, Paronite, ebonites, and asbestos-filled materials. The problem of creating such curable elastic rubber-plastic composites was solved by using a fundamentally new type of polyolefinic rubber, rapid-curing chlorinated or brominated corrosion- and ozone-resistant ethylene-propylene copolymer with good compatibility, and also by using in these composites, new heat-, flame- and corrosion-resistant modified polyolefins, a number of synthetic resins, catalysts, special curing agents, fillers, plasticisers, and other components. This paper is a result of the development, testing over a period of over 20 years, introduction, and service of the given high-performance elastic polymeric materials. 25 refs. (Article translated from Plasticheskie Massy, No.2, 2002, p.32-42).
RUSSIA
Accession no.878724

Item 33
Modern Plastics International
33, No.2, Feb.2003, p.37-8
AUTOMOTIVE, SOFT-TOUCH MARKETS PROMISE STRONG YEAR
Rosenzweig M
PolyOne predicts that the global thermoplastic elastomer market will grow 6-7% this year. This will primarily be driven by increased penetration of the automotive and construction sectors by TPV and TPO technologies, largely at the expense of thermoset rubber and traditional vinyl products. The company also foresees significant growth for styrenics in the consumer goods sector, especially in soft-touch applications. TPE consumption in China will grow 10-11%, thanks largely to exports of consumer goods, it is claimed. Sales of TPEs, both resins and compounds, totalled about 1.134 million tonnes, worth 4.5bn US dollars last year, with North America accounting for 41% of the demand, Europe 37% and Asia-Pacific 18%.
WORLD
Accession no.879961

Item 34
FAPU
German
THERMOPLASTIC POLYURETHANE
Scholz G
Elastogran GmbH
This article reviews the wide applications of polyurethane from a polyaddition of a diisocyanate with a dialcohol in
the areas of daily life like cars, transport, civil and underground engineering and construction, electrical and machine construction, leisure, furniture and shoes as well as food and medical technology. Thermoplastic elastomers are examined along with their different groups like polyolefin blends, crosslinked elastomer particles, pure styrene copolymers with a block structure and other block copolymers based on ethoxyethanes and esters, amides or even urethanes. The morphological structure of thermoplastic polyurethane is studied along with the chemical structure of urethane.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.878610

Item 35
Polimery
47, No.4, 2002, p.229-33
Polish
THERMOPLASTIC ELASTOMERS
MANUFACTURED OF POLYMER BLENDS
Rzymski W M; Radusch H-J
Lodz,Polytechnic; Halle, Martin-Luther-Universitat

A review is presented on thermoplastic elastomers composed of polymer blends covering the period 1990 to 2001. It deals with thermoplastic polyolefin elastomers, thermoplastic vulcanisates, melt-processable rubber and thermoplastic elastomeric ionomers. 55 refs.

EASTERN EUROPE; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; POLAND; WESTERN EUROPE

Accession no.878355

Item 36
China Plastic & Rubber Journal
DEVELOPMENT OF TPE IN CHINA

China is one of the largest rubber overshoe producers in the world. Tremendous rubber overshoe output ensures a steady demand for styrene elastomer. On the other hand, the demand for polyolefin elastomer by the rapidly-developed automotive industry has witnessed quick growth. In addition to the demand for thermoplastic elastomer (TPE) by industries such as construction material, tools and toys, the total demand for TPE in China in 2006 is forecast to reach 358,000 tonnes and its annual growth rate to reach 10%, almost twice the world’s average annual growth rate. Some details and statistics are presented.

CHINA

Accession no.878222

Item 37
Macplas International
Nov.2002, p.64
WORLD RUBBER CONSUMPTION

This article provides economic information on both global rubber consumption, and world demand for thermoplastic elastomers. Figures are taken from two recently-published reports by the Freedonia Group. The reports state respectively that global consumption of rubber is forecast to increase 3.8 percent per year to 21 million tons in 2006, and world demand for thermoplastic elastomers is forecast to expand 6.4 percent per year, to 2.15 million tons in 2006.

FREEDONIA GROUP
AFRICA; ASIA; ASIA-PACIFIC; CHINA; EASTERN EUROPE-GENERAL; INDIA; JAPAN; MIDDLE EAST; NORTH AMERICA; TAIWAN; WESTERN EUROPE; WORLD

Accession no.877892

Item 38
Brookfield, Ct., SPE, 2001, Paper 41, p.401-11, 27 cm, 012
COLORANT BLUES: THE EFFECT OF COLOR ON PROCESSING TPVS
Schramski J
ACRA Inc.
(SPE, Detroit Section)

A common belief in the injection moulding industry is that colourants do not affect the injection moulding process. The difficulty of processing thermoplastic vulcanisates (TPVs) is enhanced when colours are introduced. It is shown that the additives used to create a desired visual appearance can, under certain circumstances, negatively impact the process. The data show that high scrap rates of 9%, 10% and 14% for the three colours of tan, blue and grey, respectively, are generated at average cycle times above 53 seconds during production of a TPV automotive interior component. The scrap rates for these colours at average cycle times below 53 seconds are 3%, 3% and 2%, respectively. In a trial conducted with natural TPV, the scrap rate is 1% regardless of the cycle time. The data support the conclusion that colourants affect the moulding process and do so to varying degrees. This is due to the different constituents that are added to make any given colour and their relative propensity to react with the rubber phase, thereby degrading the polymer. This degradation of the resin leads to variation in viscosity, and ultimately the process, translating into scrap. Injection moulders should observe two basic elements for the successful production of TPV components in colours for the automotive market. First, ensure that the part design and gate location optimise melt flow conditions and provide a broad processing window. Preliminary analysis of a three-dimensional mathematical model with mould flow software in the design stage is an invaluable tool for accomplishing this goal. Second, prevent degradation by minimising the residence time through proper machine selection, thoughtful mould design and maintenance of target cycle times. 3 refs.

USA

Accession no.877742

42 © Copyright 2003 Rapra Technology Limited
INNOVATIVE BLOW MOULDING SOLUTIONS VIA NOVEL HIGH PERFORMANCE TPOS

Ramanathan R; Finlayson M; Novak L; Crabtree S; Sammler R L; Read M D
Dow Automotive; Dow Chemical Co.
(SPE,Detroit Section)

Large part and/or technical blow moulding has historically suffered from the lack of a palette of materials designed for the process. Additionally, PPs have had the drawback of not possessing sufficient melt strength for the blow moulding process. Recent efforts to address these points have resulted in new PP and TPOs that not only possess high melt strength (approaching that of high molecular weight HDPE), but also a remarkable balance of physical properties. This new material technology has spurred innovative solutions via blow moulding for automotive parts. 7 refs.

USA
Accession no.877741

NEW RTPOS FOR MID-WALL THICKNESS BUMPER FACIAS

Barrera M E; Blank D R; Dammann M J
Basell USA Inc.
(SPE,Detroit Section)

Since the late 1980s, reactor grade TPOs (RTPOs) have gained wide acceptance in the automotive fascia market segment as reliable and cost effective contributors to the overall bumper system. As demands have changed over the years, so have RTPOs. The evolution of RTPO grades from conventional, ~7 dg/min melt flow rate (MFR), medium flexural modulus (500 MPa) resins, to ~20 MFR, 950 MPa flexural modulus grades. The newer, high flow grades exhibit excellent mould filling characteristics, a very favourable impact/stiffness balance, and very good low temperature ductility. Additionally, they demonstrate exceptional paintability as evidenced by very well balanced paint adhesion, durability and ductility. Based on their desirable property profiles and excellent processing characteristics, these new RTPOs become ideal candidates for lightweight, mid-wall (~2.8 mm) bumper fascia applications.

USA
Accession no.877732

ADVANCES IN UV STABILIZATION FOR INTERIOR AUTOMOTIVE TPO SYSTEMS

Sanders B A
Cytec Industries Inc.
(SPE,Detroit Section)

Thermoplastic olefins (TPO) is evolving as one of the primary materials for automotive interiors. The role of hindered amine light stabilisers (HALS) in the protection of TPO continues to expand. HALS are essential components in formulations developed for interior automotive applications and have been proved to be effective thermo-oxidative stabilisers. The physicochemical properties of hindered amines have a profound effect on the hindered amines’ performance as a stabiliser, and will also influence the reactivity of the HALS with other formulation components. Some of these interactions can have a deleterious effect on end product aesthetics and service life. Currently, one single TPO formulation is not capable of performing adequately in all of today’s demanding processes and complex matrices. Studies on the relationship between UV stabiliser structures and performance have led to the development of a new light stabiliser system developed specifically for automotive TPOs. Alternative stabiliser systems to improve light stability, chemical resistance and thermo-oxidative protection of interior automotive TPO formulations are examined. There may be a single TPO formulation that will meet all the demanding requirements of interior applications. 21 refs.

USA
Accession no.877728
DEVELOPMENT OF ETHYLENE/ALPHA-OLEFIN COPOLYMER ELASTOMER COMPOUNDS WITH IMPROVED THERMOFORMING CAPABILITY
Walton K L; Pomije J D; Gisler E S
DuPont Dow Elastomers LLC
(SPE,Detroit Section)

Ethylene/alpha-olefin copolymer elastomers based on single site constrained geometry catalysts exhibit a number of physical properties that make them extremely useful for automotive interior applications. Their inherent flexibility eliminates the need for plasticisers which can volatilise, causing fogging problems and shorter product life. Due to the low level of unsaturation in these polymers, they exhibit outstanding heat and UV ageing resistance. Their molecular structures enable these polymers to exhibit low glass transition temperatures (Tg) and excellent low temperature impact ductility. There are now commercial soft grade TPO compounds that exhibit a good balance of properties for automotive interior skins. New compounds containing higher levels of ethylene/octene copolymer elastomers have been developed which show a broader thermoforming window and greater high temperature extensibility than previously reported. The relationship of compound components to thermoforming characteristics are also discussed. 8 refs.

USA
Accession no.877717

SUMITOMO TPE AND ESPOLEX: OLEFINIC THERMOPLASTIC ELASTOMER FOR INJECTION MOLDING, EXTRUDING AND SLUSH MOLDING (AUTOMOTIVE APPLICATION)
Imai A; Hamanaka T; Sugimoto H; Ooyama H
Sumitomo Chemical Co.Ltd.
(SPE,Detroit Section)

Sumitomo Chemical has developed TPOs (olefinic thermoplastic elastomers), Sumitomo TPE in injection moulding and extrusion moulding and Espolex in slush moulding. The TPOs are used in various fields, for example in automotive, construction, electronics, medical and stationery. Emphasis is presented on TPOs in automotive applications. Airbags are set in the driver’s steering wheel and instrument panel of a vehicle to protect the driver and the passengers in a crash. It is important to select the materials for the airbag cover because the cover is able to be deployed without producing brittle small pieces even in the lower temperature in the crash. The materials need to have a high-level impact resistance. Superior TPOs are achieved by controlling the morphology in the producing process. Particle size of rubber polymer in TPO is especially important, and the smaller the diameter of the rubber particle, the higher the Izod impact strength. By combining several techniques superior TPOs with good impact strength, durability, mouldability and dimensional stability are obtained. The TPO does not break range -50 to +100 deg.C and even in a high rate impact breaking test at 50 deg.C the TPO behaves like a ductile material. Superior TPOs have with good mouldability and better processability than PVC have also been achieved for interior skin applications. The company also developed a new TPO for slush moulding which has already been deployed in the instrument panel of a Japanese car. 10 refs.

JAPAN
Accession no.877715

CELLULAR TPO PRODUCTS - ALTERNATIVES TO CROSS LINKED PE AND PVC
Wise R D
Wise Industries Inc.
(SPE,Detroit Section)

Recent developments in material science as well as extrusion technologies have led to the introduction of a new a family of cellular TPO products, positioned for use in automotive applications. By utilising high melt strength PP technology with a variety of elastomeric rubber compounds and compatibilisers, Avacel cellular TPO products have been developed that offer the softness and durability of crosslinked PE and PVC foams. By alternating concentrations of components, physical and mechanical properties can be altered without compromising thermal stability. Advances in extrusion processing, physical blowing agents and die design have led to the full scale production processing, design of high quality thermoplastic cellular articles that are non-crosslinked, completely recyclable and can be produced at lower cost than traditional crosslinked processes.

USA
Accession no.877712
TACTILE AND VISUAL EFFECTS WITH TPVS
Maurel C; Laurent D
Advanced Elastomer Systems NV/SA
(Rapra Technology Ltd.)

Frequently, parts are designed with a combination of two
different materials to produce dual hardnesses. The
combination of hard and soft materials provides the
possibility to create many tactile and visual effects. This
design capability enables a structural component to be
combined with a soft grip material, or multiple colours to
be easily combined. In many cases, the appearance or
feel of a product to the consumer is as important as any
other characteristic. Santoprene thermoplastic vulcanisate
(TPV) from Advanced Elastomer Systems (AES) offers
a variety of soft look, soft feet and soft grip capabilities
across a wide range of hardnesses. These various textures
match a range of touch sensations leather for a suitcase
or the human hand for a tool, to give just two examples.
With the introduction of multi-shot moulding technology
there is no limit to combining several plastic materials.
The possibility to have a logo or a brand name by
combining a rigid plastic and a Santoprene TPV is an
illustration of this concept. By using special pigments,
distinctive effects can be created with Santoprene TPV
such as metallic (e.g. gold, silver), pearl lustre, marble or
transparent. Several decorating techniques are valid for
TPVs, such as permanent laser marking, hot stamping
foils, heat transfer labels, or screen and tampo printing.
Experiments with these well-known techniques using
Santoprene TPV have been fine-tuned and have led to
specific recommendations to achieve the final results
required by OEMs and end users. 6 refs.

INNOVATIVE THERMOPLASTIC
VULCANIZATES FOR AIRBAG COVERS
Willems E; Ozinga C
DSM Thermoplastic Elastomers
(SPE)

Automotive airbag covers are required to tear without
fragmentation over the temperature range -35 C to 85 C,
without significant ageing for periods up to 10 years.
Airbag deployment is very rapid, and the impact
properties of thermoplastic vulcanisates (TPV) used for
airbag covers are rate-dependent. The polypropylene,
ethylene-propylene-diene terpolymer, plasticisers and
fillers used in standard TPVs were modified or replaced
to develop a new TPV to meet the specifications of the
automotive industry, particularly low temperature impact.
The results from dynamic mechanical thermal analysis (-
80 to -40 C), falling dart impact (-60 C), notched Izod (-
70 to -10 C) and stress-strain properties at -35 C are
presented to demonstrate the suitability of the new TPV
for airbag cover applications.

OVERMOLDING OF TPES: ENGINEERED
SOLUTIONS FOR CONSUMER PRODUCT
DIFFERENTIATION
Venkataswamy K; Varma R; Ripple W
GLS Corp.

From the traditional usage of TPEs in rubber replacement,
emerging consumer market trends have driven the
overmoulding concept to commercial reality. Designers
for consumer products are setting the pace for material
developers to provide solutions that offer a combination
of aesthetically pleasing look and feel along with
demanding end-use functional performance. This article
covers general aspects of overmoulding technology and
TPES as a class of materials that offer engineered solutions
for this trend. Adhesion of TPEs with engineering
thermoplastics is discussed. 4 refs.

SOLVAY TOUTS TPOS FOR NEW AUTOMOTIVE
USE
Begin S
Solvay Engineered Polymers is pitching its thermoplastic
olefins for the carrier component on automotive door
window belt-line seals made of thermoplastic vulcanisates. The carriers in TPV seals typically are made of rigid PP to keep the inner and outer belt-line seals in place. As seals move to TPVs, designers must take into account the thermal expansion of the seal and carrier. Solvay’s Sequel and DexFlex grades exhibit less expansion over a broad temperature range, it is claimed, making shrinkage less of an issue.

SOLVAY ENGINEERED POLYMERS INC.
USA
Accession no.876270

Item 51
Kunststoffe Plast Europe
THERMOPLASTIC ELASTOMERS (TPE)
Werner T; Fehlings M
DuPont

The use of thermoplastic elastomers (TPE) to replace crosslinked elastomers and flexible polyvinylchloride in many applications continues to increase. The variety of TPE materials covers a wide range of chemical types, based on styrene (TPE-S), polyolefin (TPE-O), polyurethane (TPE-U), polyether-ester (TPE-E) and polyamide (TPE-A). Materials may be produced by compounding of different thermoplastic polymers, or of a thermoplastic with a crosslinked flexible phase, or chemically by block polymerisation to obtain polymeric chains with flexible and rigid phases. This wide variety of materials leads to a wide range of applications requiring hardnesses of between 20 Shore A and 90 Shore D. Use in automotive and other domestic and industrial applications is widespread, in both trim and mechanical parts. Colouring, decoration and foaming of the materials lead to use in many different areas, and developments continue to improve these materials in both physical performance and operating temperature envelope. 18 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; SWITZERLAND; WESTERN EUROPE
Accession no.873489

Item 52
VIBRATION WELDING OF TPO AND RECYCLED TPO
Wu C-Y; Miehls B
Visteon Corp.
(SPE,Detroit Section)

Thermoplastic polyolefins (TPO) have been used extensively in the automotive industry; however, the information about using vibration welding to join these materials is limited. A design of experiments (DOE) is performed on virgin TPO to determine near optimal welding condition, and the effect of regrind coil concentration on the vibration welded joints is studied. A three-factor (meltdown, pressure and amplitude) two-level full factorial design of experiments is performed on natural TPO. Additionally, the effects of weld time pressure and amplitude are studied as a function of the regrind concentration. DOE results indicate that the welding time is a strong function of the vibration amplitude, and that the weld strength is not sensitive to the welding parameters used. The maximum joint strength for a virgin T-joint sample is 60% of the base material strength. In addition, high regrind concentration reduces joint strength by as much as 20%. All regrind materials prefer longer welding time. Weld pressure does not affect the joint strength significantly for the regrind materials. All the regrind materials show highest joint strength when 1.5 mm peak-to-peak vibration amplitude is used. 8 refs.
USA
Accession no.873706

Item 53
NEW DEVELOPMENTS IN TPO AUTOMOTIVE EXTERIOR ORNAMENTATION
Bawal M; Blanl D; Dammann M
Basell USA Inc.
(SPE,Detroit Section)

Reactor and compounded grades of thermoplastic polyolefin (TPO) products currently in the marketplace have comparatively high mould shrinkage and thermal expansion characteristics. The need for better fit and finish of TPO parts mounted on exterior sheet metal has given rise to the development of newly designed TPOs with improved appearance and reduced dimensional change over a broad temperature range. These factors allow not only reduced moulded and painted part variability, but also more pleasing aesthetics and the ability to narrow design gap tolerances. 7 refs.
USA
Accession no.873706

Item 54
Brookfield, Ct., SPE, 2002, Materials Session, p.231-46, 27cm, 012
SPECIALTY POLYOLEFIN ELASTOMERS WITH ISOSTATIC PROPYLENE CRYSTALLINITY AS COMPONENTS OF TPO FORMULATION
Dharmarajan N; Datta S; Williams M G; Pehlert G J Exxomobil Chemical Co. (SPE, Detroit Section)

Thermoplastic olefins (TPOs) are mainly immiscible blends containing a dispersed phase of a polyolefin elastomer with isotactic PP. They combine the desirable properties of excellent stiffness with high impact strength. Within these attributes, it is particularly important to have high impact strength at sub-ambient temperatures. Numerous attempts at improving the performance of TPO by improvements in the elastomer design are described. The most notable of these are the use of amorphous ethylene-propylene (EP) copolymers for low temperature performance, the use of highly branched EPDM for the easy dispersion of the elastomer into very small particles, the introduction of ethylene elastomers containing octene and hexene instead of propylene for a closer match of the solubility parameters of the two phases. Inherent in these attempts is the understanding that the properties of TPOs depend to a large extent on the strength and the extent of the interface between the elastomer and the isotactic PP phase. A novel approach to the formulation of TPOs is described. The synthesis of discrete specialty elastomers which have both propylene and ethylene crystallinity leads to compositions wherein the interface between the dispersed elastomer phase and the isotactic PP is strengthened by an interfacial co-crystallisation of the PP matrix and the dispersed elastomer. This hypothesis, verified in the interface morphology of the blend, leads to very significant improvement in the properties of the TPO. It is obvious that this improvement of having the elastomeric modifier to possess both ethylene and isotactic propylene crystallinity provides a new avenue for the improvement in the properties of TPO formulations. 8 refs.

USA

Accession no.873700

Item 56

Rubber Chemistry and Technology 75, No.1, March-April 2002, p.49-63

THERMOPLASTIC ELASTOMERS AND RUBBER-TOUGHENED PLASTICS FROM RECYCLED RUBBER AND PLASTICS

Liu H; Mead J L; Stacer R G

Massachusetts, University

The results are reported of an investigation carried out to produce novel thermoplastic elastomers and toughened plastics by blending various recycled rubbers having different particle sizes with virgin polypropylenes having different molec. wts. The recycled rubber compounds employed were EPDM, SBR and an SBR/NR blend obtained from sources, such as shoe soles, roofing and scrap tyres. The rheological and mechanical properties of the blends were determined and experiments performed to improve the properties of the blends through compatibilisation and reactive mixing. 34 refs. (ACS Rubber Div. Meeting, 4-6 April, 2000, Dallas)

USA

Accession no.873650

Item 57


DEVELOPMENT OF A NEW ELASTOMERIC HOMOPOLYMER POLYPROPYLENE

De Belder G; Boswell E Procter & Gamble Co. (SPE)

The synthesis of elastomeric polypropylene by the introduction of stereo errors along isotactic
polypropylene chains is briefly described. Regular sequences of isotactic and tactical blocks are excluded. Linear, thermoplastic, elastomeric polypropylenes with isotacticities in the range 12.5-60% of (mmmm) pentad may be synthesised using asymmetric, metallocene catalysts and activators and a range of processes. Polymers ranging from semicrystalline thermoplastic to thermoplastic elastic may be produced according to the catalyst system and processing conditions which are used. They have the potential to replace commercial thermoplastic elastomers and flexible poly(vinyl chloride) for medical applications. 5 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.872900

Item 58
Brookfield, Ct., SPE, 2002, Materials Applications Session, p.143-62, 27cm, 012
EFFECT OF TPO COMPONENT RHEOLOGY ON FLOW-MARK FORMATION IN INJECTION MOULDING
Patham B; Jayaraman K
Michigan, State University
(SPE, Detroit Section)
Six TPO blends showing different degrees of severity of flow lines (tiger striping) upon injection moulding are examined. Of these, the surface morphology of two reactor made TPO blends is examined in detail following injection moulding. Strain rate dependent extensional viscosity curves of the components of all blends are determined using skin-core flow through a semi-hyperboloidal die in a capillary rheometer. In addition, the longest relaxation times of the blend components are determined using dynamic mechanical testing in a parallel plate fixture. These data are used to identify the most relevant factors determining the severity of tiger striping. The results reveal that lowering the viscoelasticity of the dispersed phase relative to the matrix is key to controlling the severity of tiger striping. 16 refs.
USA
Accession no.872081

Item 59
Brookfield, Ct., SPE, 2002, Interior Applications Session, p.55-8, 27cm, 012
ADVANCES IN THERMOFORMABLE TPO MATERIALS FOR INTERIOR TRIM
Bragole R; Yang C
Haartz Corp.
(SPE, Detroit Section)
The replacement of PVC for automotive interior trim applications continues to be a major objective of the automotive industry. The Big 3 has mandated its elimination over the next several years. The change from PVC to other thermofomable materials has created several new challenges for formulators. TPO has emerged as one of the most viable substitutes for PVC. It has not been an easy switch and initial TPO candidates lacked grain retention, had narrow processing windows and were high in cost. Haartz has devoted considerable R&D resource to the development of TPO sheet and laminate products that have overcome the initial TPO shortfalls. These new products have been developed for both male and female thermoforming, and offer the advantages of superior grain definition, low gloss, soft feel, excellent processability and competitive pricing. This has been achieved by concerted formulation efforts, improved methods of evaluation and a strong commitment by the Haartz management to R&D. Emphasis is placed on the initial formulation work, the methods of evaluation, the

Driver and passenger safety continues to grow in importance due to regulatory and market drivers. Driver and passenger airbags have saturated most vehicle models being introduced today. Also, more advanced airbag technology is penetrating other areas of the vehicle to include occupant protection for side and rollover collisions. The increasing demands in airbag technology have challenged the materials specified for these applications to extreme levels. The evolution of material and design solutions has been met thus far with thermoplastic olefins or TPOs, polyetherester elastomers or COPE, and styrene-block-copolymers SEBS material offerings. The use of thermoplastic vulcanisates or TPVs has been limited because of their inability to address all critical temperature dependent airbag requirements with a single grade of material. However, recent material developments in TPVs lend themselves to providing total airbag performance solutions. The use of TPVs for airbag design and development is examined in the context of providing useful analytical tools for establishing the suitability of TPVs and also in comparing TPVs to other material offerings.
EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.872073

Item 60
Brookfield, Ct., SPE, 2002, Interior Applications Session, p.49-53, 27cm, 012
NOVEL TPV GRADES FOR AIRBAG COVER APPLICATIONS
Fleischmann R; Aagaard O; Ozinga C; Willems E
DSM Thermoplastic Elastomers
(SPE, Detroit Section)
formulations now available and the applications where these formulations can be used.

USA
Accession no.872072

Item 61
Chemical Engineering
109, No.11, Oct.2002, p.50-3
FOR RIGIDITY PLUS ELASTICITY: STYRENIC BLOCK COPOLYMERS
Southwick J G; Vonk W
Kraton Polymers Inc.

Thermoplastic elastomers (TPEs) consist of either block copolymers or blends of polymers that form a soft elastomeric phase and a hard rigid phase. As this comparatively new family of polymeric products is versatile and is finding diverse markets, engineers can benefit from an awareness and understanding of them. Of particular interest are TPEs in which the rigid phase consists of PS. The chemical and physical behaviour of TPEs can better be understood by putting them in context. Traditional elastomers are composed of amorphous, flexible chains of high molecular weight polymer that are to some extent chemically crosslinked. According to the classic theory of rubber elasticity, the polymer coils function as 'entropy-driven springs'. In an unstressed condition, the elastomeric coils are in a state of maximum entropy - non-oriented, entangled conformations. As the elastomer is stretched, the material cannot viscously flow, due to crosslinking, and the coils become extended to lower and lower states of entropy. Removal of the stress allows the material to spontaneously revert to the state of maximum entropy as dictated by thermodynamics. The degree of flexibility in the particular polymer molecules governs the 'snap-back' continue characteristics of the polymer. Styrene block copolymers (SBCs) can be efficiently manufactured via anionic polymerisation. They offer properties useful in adhesives, asphalt modification, extruded and moulded goods, and footwear. The most commercially successful SBCs have either polybutadiene or polyisoprene as the elastomer soft phase; these copolymers are referred to as SBS and SIS, respectively. Their basic polymerisation process is described, as is their molecular architectures and applications. 6 refs.

BRAZIL; USA
Accession no.871820

Item 63
Rubber World
227, No.1, Oct.2002, p.31-3
ELECTRICAL APPLICATIONS FOR TPVs
Pfeiffer J E; Smola J D; Gustin C
Advanced Elastomer Systems LP; Advanced Elastomer Systems NV/SA

Thermoplastic elastomers (TPEs) are materials that consist of a blend of rubber and plastic phases. TPE materials have a good balance of rubber engineering properties but can be processed on conventional thermoplastic processing equipment such as extruders or injection moulding machines. Within the class of TPEs, an interesting subset is the family of thermoplastic vulcanisates (TPVs). These materials consist of a fully-cured rubber phase contained in a continuous thermoplastic matrix. The continuous phase is most often PP, while the cured rubber phase is usually EPDM. These materials have an even greater degree of rubber-like characteristics as superior sealing behaviour denoted by low compression et properties. They are extremely flexible materials that the feel of rubber. These TPV materials also have outstanding heat resistance, chemical resistance and cold temperature performance, in comparison to other TPE materials. TPVs, in general, have outstanding electrical properties. This superior electrical performance has led to many commercial applications within the electrical wire and cable application area. They are noted for their flexibility, good heat resistance, and can easily be compounded with additives for flame retardancy or other demanding performance requirements. TPVs also have the same superior electrical properties as
other materials. In addition their superior chemical and heat resistance have led to wire and cable applications that traditional TPE materials cannot penetrate. These materials are also compounded to meet speciality performance needs such as flame retardancy, wet electrical stability and additional heat resistance. Within wire and cable applications, these specialised performance requirements are often needed, combined in one specialised compound. 2 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE
Accession no.871819

Item 64
162nd ACS Rubber Division Meeting - Fall 2002.
Akron, Oh., ACS Rubber Division, 2002, Paper 67, pp.10, 28cm, 012

RELAXATION AND MECHANICAL PROPERTIES OF FOAMED THERMOPLASTIC VULCANIZATES
Schrader S; Sahnoune A
Advanced Elastomer Systems
(ACS,Rubber Div.)

The relaxation behaviour and response to cyclic loading of foamed thermoplastic vulcanisates based on a blend of PP and EPDM were investigated and compared with mechanical data for a typical EPDM sponge material currently used in automotive weather stripping. It was found that the foamed thermoplastic vulcanisates exhibited better long-term force retention and performed similarly or better than EPDM over extended time periods and several loading cycles. 9 refs.

USA
Accession no.871369

Item 65
162nd ACS Rubber Division Meeting - Fall 2002.
Akron, Oh., ACS Rubber Division, 2002, Paper 65, pp.17, 28cm, 012

HARD/SOFT OVERMOLDED PARTS WITH KRAIBURG TPE THERMOLAST K: MATERIAL COMBINATIONS, PROCESSING, TESTING OF ADHESION
Saenger J; Kraiburg TPE GmbH
(ACS,Rubber Div.)

The influence of material combination and processing on the adhesion of overmoulded parts made from rigid thermoplastics and soft SEBS-type thermoplastic elastomers (Thermolast K) was investigated using a specially developed peel test and the factors affecting adhesion performance examined. The effects of injection moulding parameters, such as TPE melt temperature, TPE injection speed, TPE hold pressure, tool temperature and cooling time of the thermoplastic preform on the bond strength of the TPE to various thermoplastics were also evaluated.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE
Accession no.871340

Item 66
162nd ACS Rubber Division Meeting - Fall 2002.
Akron, Oh., ACS Rubber Division, 2002, Paper 64, pp.9, 28cm, 012

TPE OVERMOLDING SOLUTIONS FOR ENGINEERING THERMOPLASTICS
Varma R; Liu D; Ripple W; Venkataswamy K
GLS Corp.
(ACS,Rubber Div.)

A report is presented on the characteristics of and design considerations for thermoplastic elastomers (TPEs) based on polyamide, polycarbonate, ABS and polycarbonate/ABS alloys developed specifically as overmoulds for engineering plastics. These TPEs exhibit excellent adhesion to various substrates, processability similar to conventional TPEs without sacrifices to cycle time and excellent physical properties for engineering applications.

USA
Accession no.871367

Item 67
162nd ACS Rubber Division Meeting - Fall 2002.
Akron, Oh., ACS Rubber Division, 2002, Paper 41, pp.5, 28cm, 012

STREAMLINING NEW PRODUCT DEVELOPMENT IN TPEs
Quarmley J; Rossi L; Morton J
Principia Partners
(ACS,Rubber Div.)

Key developments in thermoplastic elastomers are briefly reviewed and the main market drivers for these materials are identified. The leading innovators in thermoplastic elastomers and their new product development practices are examined and the value of an effective new product development process to suppliers, processors and end-users is considered.

USA
Accession no.871340

Item 68
162nd ACS Rubber Division Meeting - Fall 2002.
DYNAMICALLY Vulcanized PP/EPDM Blends: Effects of Different Types of Peroxides on the Properties

Naskar K; Noordermeer J W M
Dutch Polymer Institute; Twente, University (ACS,Rubber Div.)

The effects of different types and concentrations of peroxides, as curing agents, on the physical properties of thermoplastic vulcanizates (TPV)s based on PP and ethylene-propylene-ethylidene norbornene terpolymers were investigated at a fixed blend ratio. The influence of the decomposition mechanism, solubility aspects and kinetic factors of the various peroxides on TPV properties was examined and the main parameters governing final mechanical properties of the TPVs identified. Dicumyl peroxide was found to give the best balance of the properties tested. 25 refs.

Item 69
Akron, Oh., ACS Rubber Division, 2002, Paper 25, pp.25, 28cm, 012

NEW DEVELOPMENTS FOR OIL AND FUEL Resistant Thermoplastic Vulcanizates

Blume M; Rosin C; Schuster R H
Deutsches Institut fuer Kautschuktechnologie eV (ACS,Rubber Div.)

Thermoplastic vulcanisates (TPV)s based on either isotactic PP or polyamide and polar rubbers, such as epoxidised NR, EVA, hydrogenated NBR and ACM, were prepared by dynamic vulcanisation in an internal mixer and the phase morphology, oil resistance and mechanical properties of these TPV blends determined. The effects of the nature of the thermoplastic constituent, polarity of the rubber, blend composition, crosslinking system and degree of crosslinking on the properties of the blends were evaluated and the properties of the PP and polyamide-based TPVs compared. 19 refs.

Item 70
Akron, Oh., ACS Rubber Division, 2002, Paper 24, pp.21, 28cm, 012

NOVEL Thermoplastic Vulcanizates WHICH Demonstrate Excellent Adhesion to Metal Substrates During Melt Processing

Hill M; Goncy M
Advanced Elastomer Systems LP (ACS,Rubber Div.)

The adhesion of a standard thermoplastic vulcanisate (TPV), Santoprene 8201-70 to cold rolled steel coupons using Chemlok 487 A/B, as the adhesive system, was investigated to benchmark the state-of-the-art in olefinic TPV adhesive technology. This was followed by a study of the direct adhesion of Santoprene 8291-85 TL to several metal substrates during melt processing (Rolltrusion and insert injection moulding) using several design of experiments. The data obtained revealed that the Santoprene 8291-85TL grade exhibited excellent adhesion to various metals during Rolltrusion and that adhesive strength improved as the melt temperature and insert preheat temperature increased. 6 refs.

Item 71
Akron, Oh., ACS Rubber Division, 2002, Paper 8, pp.20, 28cm, 012

CASE STudies FOR Thermoplastic Vulcanizates AFTER Real-Life Applications

Pfeiffer J E; Van Meerbeek A
Advanced Elastomer Systems LP; Advanced Elastomer Systems NV/SA (ACS,Rubber Div.)

Several real-life case studies involving thermoplastic elastomers, which demonstrate the recyclability, performance in dynamic applications and performance after outdoor exposure of these materials, are presented and discussed. These case studies are concerned with the recycling of TPV rack and pinion boots, testing of the physical properties of TPV automotive roof tiles after removal from scrap vehicles, long-term performance of TPV expansion joints recovered from a parking deck and testing of an aged railroad pad and of a TPV used as a replacement for thermoset rubber in the glass-run channel of the Rover 800. 1 ref.

Item 72
Akron, Oh., ACS Rubber Division, 2002, Paper 7, pp.12, 28cm, 012
THE RUBBER/THERMOPLASTIC CONTINUUM
Rader C P
(ACS,Rubber Div.)
The history of thermoplastic elastomers, their impact on the rubber industry and the reasons for their success are briefly discussed. They are are categorised by at least four different methods (chemistry/morphology, application areas/geography, processing methods and properties/performance) and the future for these materials is considered. 5 refs.
USA
Accession no.871309

Item 73
THERMOPLASTIC VULCANIZATES IN APPLIANCES - A FANTASTIC ELASTIC SOLUTION
Wegelin R C; Narhi W E
Advanced Elastomer Systems LP (SPE)
The benefits of using thermoplastic vulcanisates (TPVs) as seals in domestic appliances are discussed. TPVs consist of a hard phase and soft rubber phase which are partially or fully crosslinked, may be processed using thermoplastic equipment, and are fully recyclable. Manufacturing cycle times are much faster than those of thermoset rubbers. Data is tabulated for stress relaxation studies at 23 C, and of ageing studies in air at 100 C, in water at 23 C and 70 C, in detergent solution 23 C and 100 C, and in aqueous chloramine at 70 C. 4 refs.
USA
Accession no.870765

Item 74
China Synthetic Rubber Industry
25, No.5, 2002, p.327-31
Chinese
PREPARATION AND PROPERTIES OF THERMOPLASTIC VULCANIZATES
Tian Ming; Liu Li; Li Qifang; Tian Hongchi; Feng Yuxing; Zhang Liqun
Beijing,University of Chemical Technology
A review is presented of the literature on the preparation technology, process conditions and microstructure of thermoplastic vulcanisates(TPV) and of the factors affecting the properties of TPV. The preparation and properties of several types of non-polar rubber/non-polar resin TPV, polar rubber/non-polar resin TPV, non-polar rubber/polar resin TPV and polar rubber/polar resin TPV are also discussed. 16 refs.
CHINA
Accession no.869094

Item 76
ROTATIONAL MOLDING OF POLYOLEFIN PLASTOMERS AND TPOS
Wenqing Wang; Kontopoulou M
Kingston,Queen’s University (SPE)
The rotational moulding characteristics of commercial ethylene-alpha-olefin copolymer plastomers (POP) in powder and micropellet form, and of a thermoforming thermoplastic olefin (TPO) (a blend of a propylene copolymer with a POP) in micropellet form were investigated. The linear viscoelastic properties were measured as functions of frequency and temperature. Particle sintering was studied using a hot stage microscope. The materials were moulded over a range of oven temperatures and residence times, and samples cut from the moulded parts were tensile tested. Defect-free POP parts with excellent flexibility were obtained by use of an appropriate combination of molecular structure and rheological properties. Sintering of the TPO was poor, attributed to high melt elasticity, making it impossible to eliminate pinholes. 12 refs.
CANADA
Accession no.868455
I WANT MY MVT

A variety of moisture-vapour-permeable films for medical and garment applications are now available from Deerfield Urethane. The thermoplastic elastomer films comfortably serve as moisture-vapour-transmission membranes. Deerfield, along with its German sister company Epurex, developed a range of breathable, monolithic TPE films based on polyether, soft-segment chemistries. Monolithic TPE films for clothing laminates are not as susceptible to surface contamination and other related problems observed with some microporous structures.

DEERFIELD URETHANE INC.
USA

THERMOPLASTIC VULCANISATES - NEW AND ESTABLISHED MATERIAL ATTRIBUTES ARE FURTHER EXPANDING THE RANGE OF END USE APPLICATIONS

Thermoplastic elastomers containing cured rubber alloyed to a thermoplastic matrix, as invented by Monsanto during the mid-1970s, have now been commercially available for over twenty years. Recently, in an effort to differentiate these highly engineered products from the many other materials that fall under the general heading of 'TPE', a more precise term was developed for this specific subset: Thermoplastic Vulcanisate or TPV. A TPV consists of micro-particles of fully vulcanised EPDM rubber finely dispersed during the TPV manufacturing process in a PP matrix, resulting in a homogenous elastomeric material that can be readily processed on conventional thermoplastic equipment. Thanks to chemistry and morphology, this combination of raw materials provides the closest mechanical properties to thermoset EPDM, providing, amongst other things, good chemical and heat resistance as well as good elastic properties over a broad temperature range. Aspects covered include attributes for automotive applications, rack and pinion steering gear bellow, weatherseals, sealing attributes, low friction attributes, corner joint attributes, recyclability attributes, cost considerations, attributes for medical applications, part cost-performance benefits, examples of TPV use in medical applications, attributes for consumer market applications, quantifying ergonomics and grip application examples. 11 refs.

SINGAPORE


EFFECTS OF DYNAMIC VULCANIZATION ON THE MORPHOLOGY AND MECHANICAL PROPERTY OF RUBBER/PLASTIC BLENDS

Chung O; Coran A Y
Akron, University (SPE)

The influence of dynamic vulcanisation on the mechanical properties of thermoplastic vulcanisates (TPV) was investigated by studying the morphology and mechanical properties of blends of various rubbers and plastics before and after vulcanisation (compression moulding). The rubbers were EPDM and NBR, and the plastics were polypropylene, crystalline poly(ethylene terephthalate) and poly(vinylidene fluoride). The morphology was converted from co-continuous to fixed rubber particulate on vulcanisation. The increase in tensile strength observed on vulcanisation was attributed to enhanced adhesion between rubber and plastic, and to the dispersed rubber morphology. It is proposed that crosslinked rubber particles were the main source of the TPV elasticity and that resistance to elastic recovery was mainly due to PP. Plasticisation of PP by oil reduced the recovery resistance. 13 refs.

USA

HIGH-TEMPERATURE TPE IS BASED ON SILICONE

Naitove M H

For automotive applications, particularly under-the-bonnet, engineers need elastomeric thermoplastics that can survive long-term exposure to high temperatures, and also contact with automotive fuels. In response to these needs, Dow Corning Corp. has developed a family of thermoplastic elastomers (TPEs) based on vulcanised silicone rubber particles dispersed in a variety of engineering thermoplastic matrixes. This article gives full details of the new “TPSiV” family.

DOW CORNING CORP.; MULTIBASE SA;
MULTIBASE INC.
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
USA; WESTERN EUROPE

For automotive applications, particularly under-the-bonnet, engineers need elastomeric thermoplastics that can survive long-term exposure to high temperatures, and also contact with automotive fuels. In response to these needs, Dow Corning Corp. has developed a family of thermoplastic elastomers (TPEs) based on vulcanised silicone rubber particles dispersed in a variety of engineering thermoplastic matrixes. This article gives full details of the new “TPSiV” family.

DOW CORNING CORP.; MULTIBASE SA;
MULTIBASE INC.
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
USA; WESTERN EUROPE

NEW COST EFFECTIVE POLYMER STRUCTURE COMBINING GOOD SEALANT AND/OR LAMINATION PERFORMANCE
Perez Moreno A
Dow Chemical Iberica SA (TAPPI)

High performance sealants are required which combine good laminate integrity and good sensory (taste and odour) behaviour. Polyolefin plastomers are used for extrusion coatings for converters and packaging. Polyolefin plastomers are a family of polyolefins made by a constrained geometry catalyst and unique process technology. They have improved comonomer incorporation which leads to lower crystallinity than LLDPE, and having lower seal initiation temperatures, lower modulus, better optics and good physical properties. Two sets of experiments were carried out, (1) using mono-layer extrusion coatings and (2) using coextrusion coatings. These were tested for hot tack performance, taste and odour, processing performance and adhesion to polypropylene and paper. The polymers have lower density and toughness making these resins desirable for numerous coating applications. They can be used to replace EVA copolymers containing a high percent of VA. The polymers have good adhesion on oriented polypropylene films and nonwoven polypropylene and have better paper adhesion than vinyl acetate copolymers with a high comonomer content.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.864576

AN ALTERNATIVE?
Vielsack F; Molter W
Kraiburg TPE GmbH

Kraiburg TPE is opening up a completely new field with its SEBS compounds. Conceived to be used for keypads and whole keyboards, these materials are possible replacements for silicone rubber. A comparison of the force displacement diagrams of a conventional LSR keyboard with the newly developed SEBS product Thermolast K shows clearly that TPE comes very near the target LSR curve. Graphs relating to this article are included in the German version p.74.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.864086

MICROMECHANICAL DEFORMATION AND RECOVERY PROCESSES OF NYLON-6/RUBBER
Oderkerk J; de Schaatzen G; Goderis B; Hellemans L; Groeninckx G
DSM; Leuven, Catholic University

Details are given of the deformation of nylon-6/EPDM blends using a ministretching device in order to study the micromechanical deformation processes. Deformation was studied using atomic force microscopy and TEM. Special emphasis is given to the possibility of rubber cavitation. 21 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.863968

VESTAMID POLYAMIDE 12 ELASTOMERS
Degussa AG

This brochure describes nylon 12 elastomers from the High Performance Polymers Business Unit of Degussa AG. PA 12 elastomers are block copolymers consisting of PA 12 segments and polyether segments. PA 12-rich products have the major properties of PA 12 while the elastomer characteristics become more apparent with increasing polyether content. Compared to other thermoplastic elastomers, PA 12 elastomers are
distinguished by properties such as low density, chemical and solvent resistance, processability, printability, impact strength at low temperatures, variable hardness and flexibility over a wide range, high elasticity and good recovery, mechanical properties which are only slightly temperature dependent, and they are free of volatile or migrating plasticisers. Information is presented with reference to processing, structure-property relationships, mechanical properties, hardness and strengths, temperature dependence, tensile creep strength, permanent set, abrasion behaviour, overmoulding and bonding, chemical and solvent resistance, and major properties.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.863246

Item 86
Modern Plastics International
32, No.8, Aug.2002, p.37
TPE MOLDING MAY KICK OUT THERMOSETS IN CVJ BOOTS
Defosse M

Blow moulding of constant velocity joint (CVJ) boots using thermoplastic elastomers for passenger cars is well-established, and the material has largely succeeded in replacing rubber and thermoset elastomers. Now, manufacturers of larger vehicles are also keen on replacing thermoset CVJ boots, axle boots and similar parts with thermoplastic versions. Ossberger, Germany, a leader in the development of injection blow moulding machines for boots, says processor interest in TPE boots for large vehicles sparked the development of its DSE 250 machine. Last summer, Bayer introduced the first extrusion blow mouldable TPU grade and is working with two European automotive manufacturers on developing extrusion blow moulded TPU boots and shock-absorber covers using Desmopan KU-2 8785 and KU-2 8791 TPUs.

WORLD

Accession no.862647

Item 87
Plastics News International
July 2002, p.20
STRONG GROWTH FORECAST FOR TPES

World demand for thermoplastic elastomers is forecast to expand 6.4%/year to 2.15 million tonnes in 2006, valued at more than 10 billion US dollars, according to a new study by the Freedonia Group. TPEs will continue to find the majority of their use is replacements for natural and synthetic rubber, as well as rigid thermoplastics and metals. In addition to direct displacement of competitive materials, TPEs are gaining many new applications in which they are over-moulded onto rigid plastic or metal components to enhance ergonomic or soft touch features on a wide range of products particularly consumer goods. The global TPE market will remain concentrated in developed countries such as the USA, Western Europe and Japan, particularly for higher performance materials such is copolyester elastomers and thermoplastic vulcanisates. However, many developing countries, particularly Asia, are rapidly expanding their positions in TPES, initially focusing on styrenic block copolymers due to their existing positions in styrene-butadiene and polybutadiene rubber, but also diversifying into compounded thermoplastic polyolefins and thermoplastic PUs. Some statistics are presented.

FREEDONIA GROUP INC.
USA; WORLD

Accession no.860920

Item 88
International Polymer Science and Technology
29, No.7, 2002, p.T/11-4
TRANSPARENT AND HIGHLY HEAT-RESISTANT TPE MATERIALS
Lu Y M; Kutka J
GLS Corp.

The use of thermoplastic elastomers at high temperatures is discussed with reference to materials based on SEBS and PP and oil, which require optical transparency. A study is made of the important parameters affecting the transparency of these materials and an investigation is undertaken as to how their operating temperatures can be increased. A method based on dynamic mechanical analysis was used to find out the approximate operating temperature. The temperature is raised at a rate of 2.8 degree C/in. and the distortion is measured. The application temperature is deduced from the graph of deformation against temperature. Within the framework of this study, the operating temperature is calculated by subtracting 28 degrees C from the temperature at which the deformation reaches 5%. The compatibility of PP with the middle block of the S-EB-S and the capacity of PP for forming an interpenetrating network with SBS, is stated to make it an ideal candidate for a co-component. Details are given of recently developed optically clear materials with operating temperatures of at least 100 degrees C. 3 refs. (Article translated from Gummi Fasern Kunststoffe, No.1, 2001, pp.39).

USA

Accession no.859554

Item 89
Grand Rapids, MI, c. 2002, pp.12, 30 cm, 27/12/02
SEVRENE & SEVRITE STYRENIC BLOCK COPOLYMER THERMOPLASTIC ELASTOMERS
Vichem Corp.

Laboratory test reports for grades of Sevrene SEBS thermoplastic elastomers are presented with detailed physical properties. The Sevrene line of thermoplastic elastomers are styrene-ethylene-butylene-styrene
compounds, characterised by outdoor weatherability and chemical resistance. The products can be modified to provide flame retardancy or improved compression set resistance. Sevrite thermoplastic elastomers are also mentioned, and are cost-effective styrene-butadiene-styrene compounds which are ideally suited to interior applications and exterior black elastomeric parts. They are both available in a variety of grades tailored to meet specific application areas. Series include the 1000 series, designed to provide controlled elasticity over a broad temperature range such as that required by airbag covers; the 2000 series which provides good compression set resistance for use in high performance sealing system applications; and the 3000 series which provides sealing capability to 85 degrees C for automotive interior applications.

USA
Accession no.859536

**Item 90**

**TEFABLOC THERMOPLASTIC ELASTOMERS**

LVM UK Ltd.; Thermoplastiques Cousin-Tessier

Tefabloc thermoplastic elastomers are based on SBS or SEBS compounds, and are used in a variety of end-use sectors, including electrical devices, household appliances and accessories, cables and packaging. The tefabloc range includes hardnesses from 25 Shore A to 50 Shore D, which allows for the manufacture of flexible or semi-rigid parts. The materials may be processed on traditional injection moulding or extrusion equipment, and their specific chemical structure allows for bi-injection, overmoulding and coextrusion with a variety of other polymers such as PE, PP, PS, ABS, and polycarbonate. A selection guide is included for grades of tefabloc which gives typical properties of grades suited to extrusion or injection moulding applications.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; UK; WESTERN EUROPE
Accession no.859526

**Item 91**

**Canadian Plastics**

60, No.4, April 2002, p.14/8

**OVER THE TOP OVERMOULDING**

LeGault M

Market studies predict the average worldwide growth rate for thermoplastic elastomers to be about 5% through 2005, compared with an expected growth of about 1% for thermoset rubber. The huge increase in the popularity of overmoulding is one of the key factors in this on-going TPE success story. Bayer has just introduced a new line of fully colourable aliphatic thermoplastic PU which are being targeted at outdoor and recreation applications. A recent study conducted by TriMax has attempted to provide the definitive answer to one of the key concerns in overmoulding - creating a strong bond between the TPE and substrate in the finished, overmoulded product. Advanced Elastomer Systems says for all Santoprene grades, and elastomers in general, maintaining the recommended processing temperature is critical to obtaining a good overmoulded part. Teknor Apex has developed a specific line of TPEs for overmoulding on a wide variety of engineering resins. Tekbond TPEs are based on SEBS chemistry.

USA
Accession no.859320

**Item 92**

**Plastiques & Elastomeres Magazine**


French

**CHALLENGES OF SOFT TOUCH**

Gouin F

The concept of soft touch is discussed, and methods for its achievement and evaluation are examined. Details are given of working groups formed by Afnor to study this subject, and a number of examples are presented of soft touch products made from plastics and thermoplastic elastomers.

AFNOR; ATOFINA; THERMOPLASTIQUES COUSIN-TESSIER; PEUGEOT-CITROEN; ADRIANT; BAYER AG
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; WESTERN EUROPE
Accession no.858859

**Item 93**

**Pawtucket, RI, 2001, pp.5, 30 cm, 24/5/02**

**TEKNOR APEX THERMOPLASTIC ELASTOMER DIVISION. SHAPING A NEW WORLD OF OPPORTUNITIES**

Teknor Apex

An overview is presented of the range of thermoplastic elastomers supplied by Teknor Apex. It features grades with features like rubber-like properties, and offers a wide selection of durometers, low compression set and high elongation. Brief descriptions are given of Monprene, Uniprene, Elexar, Tekron, Telcar, and Tekbond, with details of applications and benefits.

USA
Accession no.858090

**Item 94**

**Melton Mowbray, 2000, pp.20, 29 cm, 18/6/02**

**EVOPRENE. EVOPRENE SUPER G; EVOPRENE G; EVOPRENE COGEE; EVOPRENE GC; EVOPRENE. THERMOPLASTIC ELASTOMER COMPOUND SERIES. TECHNICAL MANUAL**

AlphaGary Ltd.

Comprehensive product data are presented for grades of Evoprene thermoplastic elastomers from AlphaGary Ltd.
Grades described are Evoprene Super G, Evoprene G, Evoprene COGEE, Evoprene GC, and Evoprene general purpose grades of styrenic TPEs. Property data are tabulated for each grade, with details of features and benefits. In particular, the fluid resistance of Evoprene G compounds is described, and Evoprene grades for the window gasket market are indicated. Flame retardant grades are also discussed. A processing guide for both injection moulding and extrusion is included with a troubleshooting guide for each.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.858081

Item 95
Brookfield, Ct., SPE, Paper 14, p.175-91, 27cm, 012
NEW DESIGN OPPORTUNITIES FOR PLASTIC/ TPE COMBINATIONS IN MOULDED GOODS
Muhs J; Whicker R; Christensen J
Trimax LLC
(SPE,South Texas Section)
The market for new injection over-moulded goods continues to grow at a pace exceeding both that of the TPE industry by itself, as well as that of the plastics industry as a whole. A very broad array of viable rigid/soft material combinations is available to designers and end users for industrial, automotive and consumer applications. As the demand for these goods continues to see dramatic increases, marketing groups at many product manufacturers are responding accordingly - driving product development to reach new heights in terms of product scope, functionality and volume. The range of applications using the material combinations, new bondable material combinations using plastic/TPE materials, a moulding process overview for incorporation into new over-moulded goods and a look to the future for new designs and new markets are presented. Opportunities for effective collaboration between end users and custom processors have never been greater. Materials, technologies, manufacturing processes and designer creativity will all continue to multiply as end users and consumers demand more value from the custom processor community in the years ahead.
USA
Accession no.857613

Item 96
Brookfield, Ct., SPE, Paper 12, p.149-63, 27cm, 012
MIXED POLYOL PRODUCT FAMILIES IN THERMOPLASTIC POLYURETHANE
Pope T; Hall M; Brown C
Dow Chemical Co.
(SPE,South Texas Section)
Dow Chemical has introduced new Pellathane thermoplastic PU elastomers (TPUs) incorporating dual polyol technology. Two new product families, the 2101 and 2104 series, have been developed. Both product families utilise combinations of polyols as the soft segment. These product families offer targeted functional performance in market segments where a lower cost option is desired versus conventional TPU resins. The 2101 series uses dual ether-based polyols and show general ether-type TPU properties. Some physical and chemical resistance properties are slightly inferior to straight polytetramethylene ether glycol (PTMEG) type TPUs at equivalent hardness but more than adequate for many market niches. They exhibit superior hydrolytic stability versus both polycaprolactone and polyadipate polyester based TPU. Pellathane 2101-85A has been demonstrated to be an excellent injection moulding resin. Moulding cycle time reductions have been demonstrated compared to standard PTMEG based ether TPU systems of similar hardness. The 2104 series uses a combination of ester and ether polyols to form the soft segment. These products offer performance between that of conventional polyester and ether based TPU resins. The chemical resistance of these resins is comparable to conventional polyadipate and polycaprolactone polyester based TPU in select chemical reagents. In others they take on more of an ether-based TPU characteristic. For example, the hydrolytic stability is improved above ester based TPU, although not quite comparable to that of PTMEG ether based TPUs. Injection moulding cycle time advantages have also been seen with Pellathane 2104-45D compared to standard polyester based TPUs of similar hardness. 10 refs.
USA
Accession no.857611

Item 97
Brookfield, Ct., SPE, Paper 10, p.117-26, 27cm, 012
THERMOPLASTIC POLYURETHANES: VERSATILITY IN FILM AND SHEET APPLICATIONS
Sardanopoli A
BASF Corp.
(SPE,South Texas Section)
Thermoplastic PUs (TPUs) have been in existence for over 40 years. The versatile features of TPU products have made it the product of selection in many demanding applications. There has been numerous research concerning the versatility of TPU products. The use of TPU in a film and/or sheet form is highlighted. The versatility of the TPU product line is described, as is the chemistry that makes it so versatile. The many features
of TPU products are reviewed, together with how these features can be translated into benefits that can be converted into advantages in several diverse end use applications. The aim is to demonstrate the versatility of TPU products in film and sheet form so that a fit for these products can be better identified. That fit can be in an up-and-coming new application currently being examined, or as a replacement for a current elastomer not quite meeting final application requirements.

USA
Accession no.857609

Item 98
Brookfield, Ct., SPE, Paper 8, p.97-106, 27cm, 012
APPLICATION DESIGN ADVANCES THROUGH TPES
Baumann M H
G.H. Associates
(SPE,South Texas Section)

Over the last 20 years, thermoplastic elastomers (TPEs) as a class of materials have had a direct and visible impact on product design. TPEs include various chemically different materials, such as: thermoplastic olefins (mechanical blends and reactor types) (TPO), styrene block copolymers (SBS, SEBS), thermoplastic vulcanisates (olefinic, acrylate) (TPV), thermoplastic urethanes (TPU), copolyester elastomers (COPE) and polyamide (COPA). Initially, thermoplastic elastomers were viewed as rubber and flexible vinyl replacements or performance enhancements over these materials. As an alternative to thermoset rubber, they offered ease of colourability, thermoplastic processing and design techniques, and recyclability. Compared with flexible PVC, they offered enhanced mechanical properties, heat resistance and resilience as well as plasticiser-free formulations. However, this approach has limited applications for TPEs especially as they involved a different manufacturing process. Producers of the initial TPE materials recognised that they would need to go to the end-users or product design teams: there had to be a system or ‘solution’ type of marketing because the TPEs were not a drop in replacement for rubber or PVC. In most cases, the material was more expensive on a per pound basis than thermoset rubber or PVC. The applications discussed demonstrate the versatility, design advantages and economic benefits of TPEs. There are many examples where TPEs have contributed to aesthetics, ergonomics, functionality and manufacturing economics in a product design. They offer manufacturers a way of differentiating their products, revolutionising a product’s design or inventing an entirely new product. 3 refs.

USA
Accession no.857607

Item 99
Brookfield, Ct., SPE, Paper 5, p.41-68, 27cm, 012
SPECIALTY TPES INTERMATERIALS COMPETITION, VALUE AND GROWTH OPPORTUNITIES
Eller R
Eller R., Associates Inc.
(SPE,South Texas Section)

Pricing pressures, slowed growth and an enlarged compounder base are reported to have intensified intra-TPE and inter-material competition. These materials competitions are examined and strategies are identified for targeting value and profitable growth. Information is based on a global thermoplastic elastomer multi-client and current auto interior soft trim studies. Factors defining the current state of the TPE industry in North America are examined, the technologies and market conditions stimulating profitable growth are identified and the implications of these technologies on growth, pricing, TPE industry structure and paths to market are described. Also covered are the current status of the TPEs at the potentially high growth rubber interface and the current status and future prospects for penetration of selected automotive applications. 8 refs.

USA
Accession no.857604

Item 100
Brookfield, Ct., SPE, Paper 4, p.33-7, 27cm, 012
THERMOPLASTIC VULCANIZATE THAT BONDS TO RIGID THERMOPLASTICS
Pfeiffer J E; Lawrence G K; Torti K S
Advanced Elastomer Systems LP
(SPE,South Texas Section)

The development of a new flexible thermoplastic vulcanisate (TPV) that bonds to a number of different rigid polymeric substrates is introduced. Detailed bonding values to ABS, polycarbonate, PC/ABS alloys and other rigid thermoplastics are given for this new material. Physical properties are presented and compared to other available bonding elastomeric materials as well as bond durability values. Processing recommendations are given for over-moulded applications using this flexible bonding TPV. Potential applications for this material include bumpers and grips for floor care appliances, soft touch grips for tools and utensils, and flexible housings for electronic instruments.

USA
Accession no.857603
**Item 101**
Brookfield, Ct., SPE, Paper 3, p.23-9, 27cm, 012
**IMPROVED MOULDED SURFACE APPEARANCE USING NOVEL THERMOPLASTIC ELASTOMERS**
Mehta S; Jacob S
Advanced Elastomer Systems LP
(SPE,South Texas Section)

With the availability of novel thermoplastic vulcanisates (TPVs) that show less surface defects such as halos, gloss variation, gate blemishes and flow lines, it is possible to injection mould uniform appearance soft-touch automotive interior parts such as coin trays, mats, cup holders, etc. These materials have excellent low fogging characteristics along with case of fabrication. Proper processing, coupled with good part and tool design, is critical to achieve defect free surface appearance using these materials. The material properties of such novel TPVs are described, together with their recommended processing parameters and guidelines to achieve a defect free part. 16 refs.
USA
Accession no.857601

**Item 102**
Brookfield, Ct., SPE, Paper 2, p.15-21, 27cm, 012
**TPV 2001: NEW TPVS EXHIBIT HIGHER TEAR AND TENSILE STRENGTH, APPROVED BY NATION'S TOP AUTOMOTIVE MANUFACTURERS**
Angus J
Thermoplastic Rubber Systems Inc.
(SPE,South Texas Section)

The evolution of automotive weatherseals has seen materials ranging from flocked cloth to latex to SBR to EPDM, and now TPVs, due to the compounds' design flexibility, reduced weight and reduced part fabrication costs, total recyclability and improved aesthetics. The mechanical properties, benefits, efficiencies and processing alternatives/solutions of the rubber industry's new TPVs are presented, with special emphasis on weatherseals for automotive, building and construction applications. There applications are extremely diverse, ranging from hood-to-cowl seals, hood-to-radiator seals, belt line seals, roof gutter seals, glass run channels and glass encapsulation. It is proposed that most static and semi-dynamic seals are extremely strong candidates for EPDM-TPVs, further noting that the benefits of considering making the switch whose results will be presented to processors and OEMs, including cost savings, easier processing, achieving 'green' recycling goals, and giving designers increased design flexibility, in addition to achieving improved weight reduction and more attractive-looking products.
USA
Accession no.857602

**Item 103**
Shawbury, Rapra Technology Ltd., 2002, Paper 16, pp.160, 29cm, 012
**RECYCLING LIMITS FOR THERMOPLASTIC POLYURETHANE ELASTOMERS**
Hepburn C; Knox G
Ulster,University
(Rapra Technology Ltd.)

Thermoplastic PU rubbers (TPUs) can be considered a model rubber for recycling. They can be reprocessed for up to six times without significant loss of tensile and extension stiffness mechanical properties. Hardness, however, will decrease by between 5-10 Shore A degrees, reaching equilibrium after the 3rd cycle. The materials show the unique feature of being able to regenerate their mechanical properties by means of a simple post-curing or annealing operation due to the presence in the molecule of a small amount of active isocyanate groups which appear to always be present irrespective of the number of processing cycles. These are excellent classical polymer models in which to study the simultaneous and often contrary requirements of in-situ chemical functionality and processability. 2 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.857599

**Item 104**
Shawbury, Rapra Technology Ltd., 2002, Paper 15, pp.160, 29cm, 012
**FOAMING AND APPLICATIONS OF THERMOPLASTIC VULCANIZATES**
Sahnoune A
Advanced Elastomer Systems LP
(Rapra Technology Ltd.)

A systematic study is presented on foaming of thermoplastic vulcanisates (TPVs) using water and a chemical blowing agent. The TPVs are foamed to different densities and their physical properties evaluated according to automotive weatherseal application requirements. The results show that the most critical properties such as water absorption, compression set, compression load deflection, elongation at break and surface appearance are well within OEM requirements. Moreover, the compression load deflection of a newly developed low hardness TPV shows reduced and favourable values over a broad range of foam.
density. A brief discussion about sound barrier properties of TPV seals is also included.

USA

Accession no.857598

Item 105

DEVELOPMENT OF A POLYPROPYLENE/ETHYLENE-OCTENE BASED TPE FOR AUTOMOTIVE FLUID HANDLING APPLICATIONS
McNally T; McShane P; McNally G M; Murphy W R; Cook M; Miller A
Belfast, Queen’s University; Teleflex Fluid Systems Europe (Rapra Technology Ltd.)

Thermoplastic elastomers based on blends of PP and metallocene-catalysed ethylene-alpha olefin copolymers (PP/EOC) with various additives are prepared using a twin-screw extruder. The mechanical, impact, rheological, thermal and chemical properties of the resultant TPEs are studied and compared with two commercially available TPEs (CTPE1 and CTPE2) based on PP/EPDM systems presently used in automotive fuel covering applications. The PP/EOC based TPE has a percentage elongation at break some three times greater than both commercial materials, is more flexible, and has better impact strength at 25 and -40 deg.C. The PP/EOC system is less viscous than CTPE1 and CTPE2 in the shear rate range normally experienced during tube extrusion, when measured using capillary rheometry techniques. The lower viscosity of the PP/EOC system is also evident during crosshead extrusion trials, with line speeds for certain grades 50% greater than that achievable with CTPE1 and CTPE2. The PP/EOC TPE passes all heat ageing and chemical conditioning tests to SAE J2027. The properties of TPEs based on PP/EOC are shown to be affected by both PP molecular weight and oil type and content. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.857591

Item 107

DEVELOPMENT OF A NEW ELASTOMERIC HOMOPOLYMER POLYPROPYLENE
De Belder G; Boswell E
Procter & Gamble Co. (Rapra Technology Ltd.)

A new elastomeric homopolymer PP has recently been developed. Its unique properties are caused by the introduction of a controlled level of stereo-errors into the PP chain. This new material has the possibility of replacing existing polymers at low cost such as thermoplastic elastomers (TPEs), flexible PVC, rubbers and other high performance polymers with the additional benefit that the polymer is completely recyclable (the only building blocks are propene). The new polymer has been successfully evaluated in different commercial polymer processes such as film casting, injection moulding, blow moulding, fibre spinning, etc. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.857590

Item 108

FREEDOM TO INNOVATE: THE CHANGING FACE OF THE TPE INDUSTRY
Morgan R P
Kraton Polymers LLC (Rapra Technology Ltd.)
The European thermoplastic elastomer (TPE) industry is undergoing an intensive period of change; it is questioned whether this is for the sake of change or if there is a real need to evolve. The significance of this to customers and markets is described. The factors behind, and potential impact of, such reorganisation are examined from the perspective of the world’s leading manufacturer and supplier of styrenic block copolymers, Kraton Polymers, one year after divestment from Shell Chemicals.

SHELL CHEMICAL CO.
EUROPE-GENERAL; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.857589

**Item 109**
**RECENT TRENDS AND OUTLOOK FOR ELASTOMERS**
Jumpasut P
International Rubber Study Group
(Rapra Technology Ltd.)

Recent trends are reviewed and a view is presented of the outlook for natural and synthetic rubber consumption and production for major regions and the world. It appears that, today, the world’s elastomer industry is dominated by Asia and by synthetic rubber. Currently, elastomer consumption has just returned to its long-term trend, but the long period of ‘under’ consumption has caused a situation of oversupply in natural and synthetic rubber, resulting in their prices falling to the lowest levels seen for quite some time. In the near future rubber consumption will more or less remain around its long-term trend and Asia will continue to dominate not only elastomer consumption and NR production, but also synthetic rubber production. There will also be an NR shortage rather than the current state of surplus, which may lead to the increased use of synthetic rubber and, in particular, TPEs worldwide. On the other hand, there is a possibility that the world rubber industry, excluding TPEs, has reached a maturity. 11 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.857588

**Item 110**
Shawbury, Rapra Technology Ltd., 2002, Paper 2, pp.160, 29cm, 012
**TPE GROWTH AND VALUE OPPORTUNITIES IN AUTO INTERIORS AND BODY SEALS**
Eller R
Eller R., Associates Inc.
(Rapra Technology Ltd.)

Opportunities for thermoplastic elastomers (TPEs) in the automotive industry are examined, in the interior of the vehicle and at the thermoset rubber (TSR) interface. Emphasis is placed on substitution opportunities that have the potential for adding value to the application and hence enhancing the profit potential for the TPE. Although the prices for TPEs are higher than for incumbent TSRS, there are a number of substitution drivers that enhance their penetration potential. In the USA, recycling is not a significant material substitution driving for TPEs vs TSRS, like it is in Europe.
USA
Accession no.857587

**Item 111**
Kunststoffe Plast Europe
92, No.6, June 2002, p.25-7
**COLOURS IN LIGHT**
Haettig J; Drube W; Kaufhold W
Bayer AG

The features of a new lightfast thermoplastic polyurethane elastomer (TPU), called Desmopan KU 2-88, which is
based on aliphatic isocyanates and enables parts to be produced in light colours, are described. This TPU is mainly designed for injection moulding and is suitable for a wide range of applications. It is also available in a crystal clear grade for extrusion, called Texin DP7-3007, which is currently being used to make tinted rear windows for the BMW Z8 Roadster. Possible future applications of this TPU are also indicated. (Kunststoffe, 92, No.6, 2002, p.93-5)

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.857173

Item 113

Thermoforming Quarterly
21, No.2, 2002, p.9-14
DIRECT SHEET EXTRUSION AND THERMOFORMING OF TPO COMPOUNDS
Malkani M; Soneta J; Mead J L; Orroth S A
Massachusetts, University

Several formulations containing a large amount of rubber were compounded on a twin-screw extruder and formed into sheets, which were then thermoformed using different techniques (vacuum forming, pressure forming, plug assist vacuum forming and plug assist pressure forming). Materials investigated included PP, an alpha-olefin elastomer, a dynamically vulcanised thermoplastic elastomer or TPV and two ionomers evaluated with a reactive polymer. The effect of material properties on thermoformability was examined for high draw applications and a processing window developed for each formulation tested. 10 refs. (SPE ANTEC 2002, San Francisco)

USA

Accession no.857150

Item 114

Rubber and Plastics News
31, No.21, 20th May 2002, p.7
ROLLER SUPPLIERS MAKE CASE FOR TPES
Dawson B

An open house was held at Remco’s Grandview, Mo., facility, in conjunction with the Rubber Roller Group meeting in Kansas City, Mo., to showcase Remco’s new thermoplastic elastomer roll builder and PolyOne’s novel thermoplastic elastomer compounds for the roller market. The new machine, designated the TPB100X, uses a plastic extruder to heat, mix and extrude a thermoplastic elastomer onto a conveyor belt, which transports the resulting strip to a roller where it is applied thereto using a specially designed applicator head.

REMCO INC.; ROLLER EQUIPMENT MANUFACTURING CO.INC.; POLYONE CORP.

USA

Accession no.853489

Item 115

Machine Design
74, No.9, 9th May 2002, p.60/5
HARD RULES FOR SOFT-TOUCH OVERMOLDING
Caamano J
Ticona

The technique of two-step injection moulding for producing a range of products with soft-touch grips and watertight seals is discussed. The advantages of this technique over conventional assembly techniques are considered and the wide range of hard-soft combinations available to meet performance requirements is outlined. Methods of achieving the best bond between the hard material and soft TPE are described and actual and potential applications are indicated as are potential TPE-thermoplastic combinations.

USA

Accession no.853470

Item 116

McHenry, Il., 2000, pp.6. 27 cms. 25/4/02
REALIZE THE POTENTIAL, FEEL THE DIFFERENCE. NEW VERSAFLEX TPE ALLOYS TECHNOLOGY. GET YOUR HANDS ON THE NEXT GENERATION OF TPE TECHNOLOGY
GLS Corp.

Versaflex thermoplastic elastomer alloys are designed for overmoulding applications. Grades are available in hardnesses from 30-65 Shore A. They are easily colourable, and can be overmoulded onto a variety of substrates, including, PP, ABS, PC/ABS, PC, propionate, and nylon. Examples of applications are given for Versaflex products and properties are tabulated for specialty grades and grades for overmoulding on particular substrates.

USA

Accession no.853055

Item 117

Stafford, 2001, pp.40. 29 cms. 25/4/02
THERMOLAST K. INJECTION MOULDING, EXTRUSION
Kraiburg TPE GmbH

An overview is presented of the properties and processing techniques for Thermolast K thermoplastic elastomer compounds based on styrene block copolymers. Detailed processing information is included for both injection moulding and extrusion processing, and troubleshooting guides are also given.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.852088

Item 118

Stafford, 2002, pp.12. 29 cms. 25/4/02
TPE HARD/SOFT SYSTEMS
Kraiburg TPE GmbH
Tabulated property data are presented for Thermolast K thermoplastic elastomers based on SEBS. Details are given of adhesion ratings and hardnesses, and physical properties are included for the various series of grades. These series include materials with improved UV resistance, transparency, improved compression set and resilience. Adhesion to ABS, SAN, ASA, PC, PC/ABS, PC/PBTP, PBTP, PETP, PETG, PMMA, polyamide, polyarylamide, polystyrene, PPO/PS, HIPS, and to Hostaform/Duracon (POM) is indicated.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.852087

Item 119
Polymer
43, No.8, 2002, p.2219-28
MORPHOLOGY DEVELOPMENT BY REACTIVE COMPATIBILISATION AND DYNAMIC VULCANISATION OF NYLON6/EPDM BLENDS WITH A HIGH RUBBER FRACTION
Oderkerk J; Groeninckx G
Leuven,Catholic University

The addition of high proportions of rubber (in excess of 50-60 wt%) to polyamide-6, whilst avoiding the formation of a co-continuous morphology was investigated. Ethylene-propylene-diene (EPDM) terpolymer rubbers and maleic anhydride-modified EPDM rubbers were added to low, medium and high molecular weight polyamides. By using reactive compatibilisation and by slightly crosslinking the rubber during melt mixing, it was possible to disperse up to 60 wt% rubber in the polyamide matrix, so improving its mechanical properties. The influences of compatibiliser, crosslinking agent and rubber:polyamide viscosity ratio on the blend morphology were studied using transmission electron microscopy. It was concluded that the polyamide viscosity must be low enough to move the phase inversion towards high rubber content compositions, whilst not being so low as to form a coarse blend morphology, resulting in poor mechanical properties. 19 refs.
BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE
Accession no.849620

Item 120
Polymer Engineering
2, No.3, April 2002, p.19/25
WEATHER SEALS
Angus J
Thermoplastic Rubber Systems Inc.

Recent developments in thermoplastic vulcanisates (TPVs) based on EPDM/PP technology, which make them particularly suitable for automotive weather seals, are described. Advances, which have been made in TPVs to improve their properties, are highlighted and tables are presented giving information on the mechanical properties of grades of NexPrene and TPV-A and the characteristics of NexCoat, a moisture curable HDPE compound for extrusion coating onto TPVs and EPDM compound substrates to improve abrasion resistance. A comparison is also made of the costs of an all TPV glass run channel versus a traditional thermoset EPDM compound with flocking.
USA
Accession no.850901

Item 121
Modern Plastics International
32, No.4, April 2002, p.51
NEW GRADES STRENGTHEN OVERMOLDING’S GRIP ON CONSUMER GOODS
Rosenzweig M

Overmoulding a soft thermoplastic elastomer onto a hard substrate on consumer goods provides aesthetic, ergonomic and functional benefits. AES foresees soft-touch demand for thermoplastic vulcanisates will reach double-digit growth by the end of 2002. The company has introduced grades of Santoprene TPV that adhere directly to a variety of metals and etched fluoropolymers. Bayer has launched three grades of Desmopan TPU designed specifically for soft-touch overmoulding. They bond to a variety of substrates including PS, ABS and polycarbonate. The company has also debuted a line of aliphatic TPU's suitable for overmoulding on outdoor products such as patio chairs.
USA
Accession no.849054

Item 122
Revue Generale des Caoutchoucs et Plastiques
78, No.798, Oct.2001, p.90-4
French
HYTREL POLYESTER THERMOPLASTIC ELASTOMER, A VERY TREND SETTING MATERIAL
Griffon J M; Brugada R; Albertone Y
Du Pont de Nemours E.I.,& Co.Inc.

The structure, properties and processing of Du Pont’s Hytrel polyester thermoplastic elastomers are examined, and a number of applications of these materials are described.
USA
Accession no.849054

Item 123

THERMOPLASTIC ELASTOMERS TO 2010. PROCESSES AND MARKETS
Margolis J
(SPE; INDUSTRIAL MATERIALS INSTITUTE)

An overview is presented of thermoplastic elastomers with reference to applications and processes. TPE developments contributing to the emerging technologies for the new millennium are discussed under the headings of molecular design, compounds and composites, and processing. Major markets considered include automotive, medical, adhesives, weather striping, soft-touch products, and construction. Thermoplastic elastomers based on copolyesters, polyamides, styrenics, olefinics, polyurethanes, and thermoplastic vulcanisates and single-phase TPEs are discussed. The paper concludes with a listing of registered trademarks.

USA
Accession no.847449

Item 124

STYRENIC BLOCK COPOLYMER COMPOUNDS
Varma R; Kutka J J
GLS Corp.
(SPE; INDUSTRIAL MATERIALS INSTITUTE)

Styrenic block copolymer compounds as thermoplastic elastomers are discussed with reference to formulating and molecular control in order to meet the physical and performance demands of the markets in which they are used. Styrene block copolymers are the largest in sales volume of all the different types of thermoplastic elastomers, and have the widest hardness range amongst all commercially available TPE chemistries. By appropriate selection of the molecular weight and relative block lengths, processability can be precisely controlled. This paper covers various fundamental market requirements that can be met by formulating a styrene block copolymer, with reference to high temperature applications, high clarity applications, high flow injection moulding applications, and overmoulding and two-shot moulding applications. 6 refs.

USA
Accession no.847444

HALOGEN-FREE THERMOPLASTIC ELASTOMERS FOR WIRE AND CABLE APPLICATIONS
Gustin C; Pfeiffer J E
Advanced Elastomer Systems NV/SA; Advanced Elastomer Systems LP
(SPE; INDUSTRIAL MATERIALS INSTITUTE)

Halogen-free thermoplastic elastomers (HFTPEs) as materials for wire and cable applications are discussed. They combine advantages such as low corrosivity, and recyclability with performance properties such as low temperature flexible, acceptable insulation characteristics and oil resistance, and outstanding flame retardancy. These new materials provide an alternative to traditional halogenated systems. HFTPE compounds based on olefin polymers also have the potential to reduce costs. An overview is presented of the types of thermoplastic elastomers available, (block copolymers, blends, elastomeric alloys, and thermoplastic vulcanisates), their definitions, nomenclature, chemistry and morphology. Features of HFTPE and the HFTPE A series are discussed. 16 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE
Accession no.847443

Item 126
Polymer Engineering and Science
42, No.1, Jan.2002, p.10-8

OIL RESISTANT THERMOPLASTIC ELASTOMERS OF NITRILE RUBBER AND HIGH DENSITY POLYETHYLENE BLENDS
Setua D K; Soman C; Bhowmick A k; Mathur G N
Defence Materials Stores Research & Development Establishment; Indian Institute of Technology

Different grades of oil resistant thermoplastic elastomers (TPE) based on blends of nitrile rubber (NBR) and HDPE are developed. Chemical treatment of HDPE to evolve compatibility with NBR and dynamic vulcanisation with different curatives are studied. Determination of physicomechanical and thermal properties and relative crystallinity of these blends are carried out. Oil resistance characteristics of the blends are evaluated in different commercially used oils and fuels for applications as a substitute for NBR/PVC blends. 28 refs.

INDIA
Accession no.846893

Item 127
Macplas
26, No.227, April 2001, p.83-8
Italian

KNOWLEDGE REQUIRED FOR CORRECT DESIGN. I
Panarotto A
Cesap
Factors involved in the design of moulded polymer products are discussed with reference to the example of Du Pont’s Hytrel 4056 polyester elastomer. Data are presented for the mechanical, dynamic mechanical, thermal and electrical properties of this material.

DU PONT DE NEMOURS E.I.,& CO.INC.; ADVANCED ELASTOMER SYSTEMS EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; USA; WESTERN EUROPE

Accession no.846235

Item 128
160th ACS Rubber Division Meeting - Fall 2001, Cleveland, Oh., 16th-18th October 2001, Paper 85, pp.23, 012

CROSSLINK DENSITIES AND PHASE MORPHOLOGIES IN THERMOPLASTIC VULCANIZATES
Ellul M D; Tsou A H; Weiguo Hu
Advanced Elastomer Systems LP; ExxonMobil Chemical Co.
(ACS,Rubber Div.)

The degree of EPDM crosslinking during dynamic vulcanisation of a PP/EPDM thermoplastic vulcanisate(TPV) was modified by varying the phenolic curing agent content. The rise in TPV viscosity, the decrease in its swelling, the reduction in chain mobility from solid state PMR and the increase in EPDM hardness from force modulation atomic force microscopy verified the corresponding increase in crosslink density with curing agent content. Bound curing agent content or diene content determined directly by solid state NMR was found to be a good measure of crosslink density and cure chemistry. SEM morphologies of cryo-faced and ruthenium-stained TPVs were obtained and analysed by image processing to determine EPDM domain sizes and PP ligament thickness. A narrowing of the EPDM domain size distribution, with a resulting decrease in the third moment of the domain size, was observed with an increase in crosslink density. Correspondingly, the PP number average ligament thickness was raised slightly. 20 refs.

USA
Accession no.843009

Item 129
160th ACS Rubber Division Meeting - Fall 2001, Cleveland, Oh., 16th-18th October 2001, Paper 83, pp.8, 012

ELECTRICAL APPLICATIONS FOR THERMOPLASTIC VULCANIZATES
Pfeiffer J E; Smola J; Gustin C
Advanced Elastomer Systems LP; Advanced Elastomer Systems NV/SA
(ACS,Rubber Div.)

The properties and advantages/disadvantages of several commercial electrical grades of thermoplastic elastomers are discussed. New development grades based on non-halogenated flame retardants and on improved heat ageing properties are described. Test methods for flame retardancy, wet electrical testing, heat ageing at specific temperatures and chemical resistance requirements are outlined. Application areas, such as submersible pump cables, flexible cords, electrical connectors and ‘covers’ for various cables, are considered. 3 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE
Accession no.842482

Item 130
Macplas International
Sept.2001, p.132-4

PRESENT AND FUTURE CHALLENGES FOR HYDROGENATED SBS THERMOPLASTIC ELASTOMERS
Gobbi C
EniChem

Styrene block copolymers are styrene-diene-based block copolymers where diene can be either butadiene or isoprene monomer. Where it is the former, the copolymers are called SBS. This article discusses hydrogenated SBS thermoplastic elastomers in detail. Section headings include: styrene block copolymers, hydrogenated styrenic block copolymers, market trends for SEBS (styrene-ethylene butylene-styrene block copolymers), current and future perspectives, and conclusions.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.842471
Item 132
Metzendorf, c. 2001, pp.6. 30 cms. 4/1/02
NOVAPRENE THERMOPLASTIC ELASTOMERS
Schafer Polymer GmbH

Processing information is presented for Novaprene thermoplastic elastomers from Schafer Polymer GmbH. The compounds are thermoplastic elastomer pellets based on styrene copolymers. Grades are available which are weldable and sterilisable and for food contact applications. Extrusion and injection moulding conditions are detailed.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.841123

Item 133
Rubber and Plastics News
31, No.8, 12th Nov.2001, p.19/21
PEBA BRIDGES GAP BETWEEN THERMOPLASTICS, RUBBER
Dennis G M; O’Brien G
Atofina Chemicals Inc.

We are told that one of the more recent additions contributing to the overall growth of the thermoplastic elastomer family of products is a polyether block amide (PEBA) resin called “PEBAX”. This paper explains the PEBA structure and how it creates a blend of properties which bridge the gap between thermoplastics and rubbers. The paper then addresses the performance characteristics of the PEBA material and the subsequent market applications served by this relatively-new family of polymers.
USA
Accession no.838599

Item 134
Shawbury, Rapra Technology Ltd., 2001, pp.166. 30 cm, Rapra Industry Analysis Report Series
THERMOPLASTIC ELASTOMERS
Dufton P
Rapra Technology Ltd.

A report is presented on thermoplastic elastomers which discusses the different families of TPEs, trends in material developments and the products currently available. Key end-use sectors covered include: automotive, general mechanical and industrial products, including tubing, cables and construction products, adhesives, footwear, medical and other markets including polymer modification, sports and leisure, and film and sheet. Each sector is examined in some detail with reference to activity in Western Europe, the investment in polymers within each sector, and how important a share of that involvement is held by TPEs. Issues affecting the choice of different materials and how these are likely to impinge on the use of TPEs in the future, are also examined. Statistical data relating to supply and consumption by material family and trends for future consumption are included. Other sections deal with the processing and testing of TPEs, the environmental issues of recycling and other factors which may impinge on the use of elastomers in general.
11 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.838076

Item 135
Canadian Plastics
59, No.7, July 2001, p.16-7
SPORTING LIFE
LeGault M

The annual growth rate, 6-8%, of thermoplastic elastomers over the past five years has been driven by expanding applications in a number of key markets. One of the most critical of these has been sports/recreation. Finproject uses an exclusive technology and DuPont Dow Elastomers’ Engage polyolefin elastomer to manufacture a kayak seat cushion. The company has developed a variety of injection-moulded foams that capitalise on the polymer’s low molecular weight and processing properties. PING, a leading manufacturer of golf clubs, uses a highly-filled, high specific gravity thermoplastic elastomer, Thermocomp HSG, for inserts in its club heads. Scubapro chose Monoprene TPE supplied by Teknor Apex for its swim fin. To make its new Fab Force swim fin, Force Fin uses a TPU and a patented manufacturing technique that eliminates the need for expensive moulds in both prototype and production.
NORTH AMERICA
Accession no.837869

Item 136
Canadian Plastics
59, No.10, Oct.2001, p.6
BUILDING A BETTER BOND

It is explained that recent developments in thermoplastic elastomer (TPE) formulations means that these high-demand soft materials are now able to bond with textiles, numerous metals, and parts made from acetal copolymers. This new capability opens up many possibilities for part integration and reduced system costs. This article looks in detail at the developments.
ADVANCED ELASTOMER SYSTEMS; TICONA; KRAIBURG TPE GMBH; SAINT-GOBAIN PERFORMANCE PLASTICS
USA
Accession no.836819

Item 137
Rubber World
225, No.1, Oct. 2001, p.36-8
FULLY VULCANIZED EPDM/PP TPV DEVELOPMENTS IN AUTOMOTIVE, BUILDING AND CONSTRUCTION MATERIALS
Angus J
Thermoplastic Rubber Systems
Details are given of the mechanical properties and processing of thermoplastic elastomers for use as weatherseals for automotive, building and construction use. Data are presented for EPDM/PP-based thermoplastic vulcanisates.
USA
Accession no.835541

Item 138
Revue Generale des Caoutchoucs et Plastiques
78, No.795, May 2001, p.54-6
French
THERMOPLASTIC ELASTOMERS: NEW OPPORTUNITIES TO GRASP
Eller B
Automotive applications of thermoplastic elastomers are discussed. Processing techniques used in the manufacture of automotive parts and the advantages of thermoplastic elastomers in terms of recyclability are examined.
GENERAL MOTORS CORP.
EU; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE-GENERAL
Accession no.835469

Item 139
Revue Generale des Caoutchoucs et Plastiques
78, No.795, May 2001, p.48-53
French
INNOVATION AT THE HEART OF PROCESSES
Biron M
Developments in techniques for rubber processing are examined with reference to the microwave vulcanisation of profiles and coextrusion and coinjection moulding processes for the production of components combining plastics with thermoplastic elastomers or vulcanisable rubbers. An examination is made of thermoplastic elastomer (TPE) grades developed by a number of companies to meet requirements for direct adhesion to plastics, and data are presented for TPE and rubber adhesion to various thermoplastics. The influence of processing, post curing and storage conditions and part thickness on the volatile content of silicone rubber vulcanisates is also discussed.
MES; SAIREM
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE
Accession no.835468

Item 140
Macplas
25, No.224, Dec.2000, p.54-6
Italian
HOT RUNNER SYSTEMS FOR MULTI-
COMPONENT INJECTION MOULDING
Gauler K
Incoe International Inc.
Hot runner systems and their use in two-material, two-colour, multi-material and multi-colour injection moulding are examined. Examples are presented of products manufactured by these processes and combining plastics and thermoplastic elastomers.
USA
Accession no.835455

Item 141
Brussels, Belgium, 18th-19th June 2001, Paper 19
TPES USED IN CVJ (CONSTANT VELOCITY JOINT) BOOT APPLICATION. CURRENT STATUS, FUTURE CHALLENGES
Khoshoei N
GKN Automotive GmbH
(Rapra Technology Ltd.; European Plastics News; Plastics & Rubber Weekly)
GKN’s viewpoint, as the leading producer of automotive driveline components, on thermoplastic elastomers (TPEs) and their growing trend is explained. TPEs are utilised for the manufacture of constant velocity joint (CVJ) boots. This is more true of ‘outboard’ (wheel-side) joints than it is for ‘inboard’ (engine-side) joints, with varying degrees depending on regional requests. Temperature requirements as high as 140-160 deg.C will not be uncommon in future ‘inboard’ applications. Such temperatures are obviously too excessive for any existing TPEs. Rubbers are currently used for inboard applications but are by no means the ideal candidate. The advantages and disadvantages of rubber vs TPE in CVJ boot applications are discussed. The need for improved characterisation of TPEs through thermomechanical analysis are also discussed in an attempt to understand better the nature of these materials, and in the hope that the resulting knowledge can help us in the search for high temperature thermoplastic elastomers. GKN has conducted a correlation study of TPE material characteristics vs boot test rig performance, leading to a regression model which has been used to predict CVJ boot performance. The model has shown encouraging results in predicting the hot performance of CVJ boots, prior to the boot being moulded, i.e. based on the information obtained from material granulates only. This approach has the potential to drastically reduce the cost of screening new TPE materials for boot applications, i.e. boot prototype manufacture and rig testing may be reduced. It can also be used in making better TPEs. 1 ref.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.835032
**Item 142**
Brussels, Belgium, 18th-19th June 2001, Paper 18
DEVELOPMENTS OF TPE IN AUTOMOTIVE INTERIORS
Golinelli G
So.F.Ter SpA
(Rapra Technology Ltd.; European Plastics News; Plastics & Rubber Weekly)

The main automotive manufacturers are pushing the tier 1 supplier to use compatible polymers to achieve easy recycling of the automobiles at the end of their life. Polymers used in the production of the automotive interiors included the soft PVC of artificial leather, PU foams used in the cushion seats, PP used in the door pocket, polyester fabrics, etc. When these polymers are blended together, the only final use of this mixture can be for energy recovery, due to the lack of compatibility. Polyolefin can be used in a wide range of applications and can be easily recycled. So.F.Ter, a joint venture with Polyone, decided to develop compounds based on TPE-V (vulcanised thermoplastic elastomer) and TPE-S (thermoplastic elastomer SEBS based) for the compounds used in the production of artificial leather to achieve compatibility with the polyolefin. These compounds show excellent characteristics: UV resistance, fogging, heat resistance, thermoforming, grain retention and abrasion resistance. These are some features which can be modified using dedicated raw materials. The compounds can be processed using the most common technologies used in the production of the sheets, such as calendering and T-die extrusion, and also in injection moulding for components that can match the main interior components.

2 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.835031

**Item 143**
Brussels, Belgium, 18th-19th June 2001, Paper 14
TECHNOLOGICAL ADVANTAGES OF POLYETHER COPOLYMER BASED TPUUs
Feijen D H W; Muller J L; Salvatella J J D; Riba M J
Merquinsa Mercados Quimicos SL
(Rapra Technology Ltd.; European Plastics News; Plastics & Rubber Weekly)

A unique family of TPUUs (Pearlthane), developed and optimised over the past two years by Merquinsa, is described. This special type of TPU is based on a soft segment composed of well-defined alternating blocks of polyester and polyether chains. After a general description of TPUUs, advantageous properties as well as the main application areas of this family are described.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.835020

**Item 144**
Brussels, Belgium, 18th-19th June 2001, Paper 13
THERMOPLASTIC POLYURETHANES WITHOUT PLASTICISER WITHIN THE HARDNESS RANGE SHORE 50-70 A
Steinberger R; Horsley S
Elastogran GmbH; Elastogran UK Ltd.
(Rapra Technology Ltd.; European Plastics News; Plastics & Rubber Weekly)

Details are given of Elastogran’s development of super-soft thermoplastic PU without plasticiser from Shore 50A-70A. The company is reported to have pioneered developments in these super soft grades of PU, which offer a alternative to other materials with its excellent adhesion characteristics, haptic feel and aesthetic appearance.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE
Accession no.835026
A TPE-V compounded by dynamic vulcanisation of epoxidised NR and PP is presented. Physical and dynamic properties are described and compared with other TPE-Vs. Oil resistance is demonstrated by comparison with NBR vulcanisate. Extraordinary heat resistance with good retention of properties on ageing at 100 deg. C and above is shown as well as its good weatherability and ozone resistance.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.835016

Item 147
Brussels, Belgium, 18th-19th June 2001, Paper 4
NEW FAMILY OF HEAT AND OIL RESISTANT TPVS
Bergastrom C; Lampinen J
Optatech Corp.
(Rapra Technology Ltd.; European Plastics News; Plastics & Rubber Weekly)

Optatech manufactures Pacrel base elastomers by impregnating PP pellets with acrylates and polymerising in the solid state. These Pacrel base elastomers are delivered to compounding companies which make Pacrel compounds using co-rotating twin-screw extruders. They can vary the properties by adding plasticiser oils, fillers, compatibilisers and other polymers and additives. Now a new family of Pacrel base elastomers made from ethyl acrylate has been developed, and in combination with improved compounding recipes excellent oil resistance at temperatures as high as 125 deg. C is obtained. With Pacrel compounds based on butyl acrylate, excellent oil resistance can be obtained at 100 deg. C but not higher. The new family of Pacrel TPVs is especially targeting automotive applications, whereas the original butyl acrylate-based Pacrel compounds are targeting other applications. Both families of Pacrel also have excellent UV and flex-resistance, and can be used for improving the oil resistance of SEBS/PP and EPDM/PP blends if appropriate plasticisers are used. Pacrel can also be used as an impact modifier and an additive to obtain adhesion to car paints.
EUROPEAN UNION; FINLAND; SCANDINAVIA; WESTERN EUROPE
Accession no.834913

Item 151
(Howerton, Tx.), 2001, pp.9. 27 cms. 17/10/01
KRATON POLYMERS AND COMPOUNDS.
TYPICAL PROPERTIES GUIDE
Shell Chemical Co.

Properties are tabulated for grades of Kraton thermoplastic rubbers, a class of block copolymer products designed for use in general purpose moulding and extrusion applications, as well as automotive and medical applications. Kraton thermoplastic elastomer yield products with a wide variety of physical and mechanical properties, and are available in grades with Shore A hardness values from 25 to 90 and specific gravities from 0.89 to 1.18. Tensile strengths of these materials range from 435 to 2100 psi. Kraton is reported to be resistant to water, alcohols, acids and bases, and some grades are claimed to have oil resistance approaching that of compounded and vulcanised chloroprene.
USA
Accession no.834309
end uses. This versatility is due to their distinctive molecular structure, which can be precisely controlled and tailored to perform in specific applications. Grades are classified into two categories: those with an unsaturated rubber mid-block constitute Kraton D, whilst those with a saturated mid-block make up the Kraton G polymers. Details are given of molecular structures, typical properties, and end-use applications.

USA
Accession no.834307

Item 152
Northbrook, Ill., c. 2001, pp.26. 27 cms. 11/9/01
ROGAN AN EXTRAORDINARY SENSE OF TOUCH
Rogan Corp.

Pure Touch products from Rogan are described. They are reported to offer the latest in thermoplastic elastomer technology, providing aesthetics with ergonomics in products such as knobs, grips, and handles. The company provides multi-material injection moulding expertise which features multi-material, multi-colour and texture combinations. The product range is described and illustrated and dimensions are given.

USA
Accession no.831568

Item 153
Revue Generale des Caoutchoucs et Plastiques
78, No.793, March 2001, p.82-4
French
THERMOPLASTIC ELASTOMERS: THE TREND IS TOWARDS MADE-TO-MEASURE MATERIALS
Berger G; Beitzel M
Kraiburg

Results are presented of a study of the resistance to light ageing of thermoplastic elastomers for use in exterior automotive applications, including an EPDM/PP blend, a styrene-ethylene butylene-styrene block copolymer, and a grade of Kraiburg’s Thermoplast K styrene block copolymers formulated for increased light resistance. Changes in colour and mechanical properties were determined after exposure times of up to 4,000 hours. The influence of processing conditions on ageing resistance was investigated by studies of injection moulded PP specimens with a thin thermoplastic elastomer surface layer.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.831347

Item 154

GIVING AN ADDED DIMENSION TO POLYPROPYLENE PACKAGING WITH ENGINEERED THERMOPLASTIC ELASTOMERS
MacLarty R G
Advanced Elastomer Systems (Rapra Technology Ltd.)

It is shown that by combining the properties of engineered thermoplastic elastomers and rigid thermoplastic with the multi-function injection moulding process methods, innovative parts can be developed. Part designers can capitalise on the advantages of both rigid and flexible materials in a single multifunctional component/system. This paper explores some of the process techniques available to the design engineer/processor, which use a combination of thermoplastic materials and multi-material injection moulding equipment, and examples are included of successful applications, which demonstrate the importance of the selection of the right grade of material from an ever increasing range of commercially available engineered thermoplastic elastomers.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.830718

Item 155
Dallas, Texas, 6th-10th May, 2001, paper 601
DEVELOPMENT OF A NEW TPV FOR BONDING TO RIGID THERMOPLASTICS
Pfeiffer J E; Lawrence G K; Torti K S
Advanced Elastomer Systems LP (SPE)

The properties of a thermoplastic vulcanisate, developed for bonding to rigid thermoplastics, are tabulated, including tensile strength, elongation at break, hardness, and tear resistance, before and after ageing in contact with a variety of solutions and solvents. Bond strengths with ABS, polycarbonate, polystyrene, poly(butylene terephthalate), poly(methyl methacrylate), and poly(ethylene terephthalate) are tabulated. With ABS in an insert injection moulding process, the optimum melt temperature was determined to be 239 C, and for two-shot injection moulding a melt temperature of 218 C is recommended. The material may be coloured using propylene-based colourants.

USA
Accession no.830033

Item 156
Dallas, Texas, 6th-10th May, 2001, paper 599
TPES IN HOT RUNNER SYSTEMS: AN ELASTIC ENTITY
Wegelin R C; Mehta S R
Advanced Elastomer Systems LP (SPE)

Hot runner systems are discussed for thermoplastic elastomers and thermoplastic vulcanisates, which have relatively high melt viscosities and exhibit compressibility. Externally heated systems are recommended, as they provide the best feed to the mould cavity, and melt channels should be sized to give a uniform pressure drop through the system. Gate types are reviewed, including flush, torpedo tip, edge, valve, and core ring. 11 refs.

USA
Accession no.829436

Item 157
NEW OPPORTUNITIES FOR THERMOPLASTIC ELASTOMERS. Proceedings of a one-day seminar held Shawbury, 19th April 1996. Shawbury, 1996, paper 6 , pp.4. 012

TPES FOR FOOTWEAR SOLINGS
Abbott S G
SATRA Footwear Technology Centre (Rapra Technology Ltd.)

The use of thermoplastic elastomers in footwear solings is discussed, with reference to trends in materials selection. An estimated breakdown is given of consumption patterns by material, with indications of the type of shoe used on. Typical hardness, density and durability ranges for soling materials is indicated with reference to thermoplastic rubber, vulcanised rubbers, PVC, polyurethanes, EVA and leather. Styrenic thermoplastic elastomers are discussed, including testing carried out at SATRA for durability, and the use of the halogenation process for solving problems relating to adhesion of the soling material.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.827831

Item 158
NEW OPPORTUNITIES FOR THERMOPLASTIC ELASTOMERS. Proceedings of a one-day seminar held Shawbury, 19th April 1996. Shawbury, 1996, paper 5 , pp.6. 012

RANGE OF VINYL AND RUBBER BASED TPES OFFERING COST EFFECTIVE SOLUTIONS FOR COMPONENT DESIGNS
Matheson A F
Hydro Polymers Ltd. (Rapra Technology Ltd.)

A review is presented of Hydro’s range of vinyl and rubber based TPEs which have been categorised into technical performance and special purpose elastomers. They include high performance Vaycron LCS, (low compression set), and low density microcellular foam, Vaycron S/LD. Technical property data are included to demonstrate performance characteristics and comparative data are included for EPDM as a reference point. Typical applications are discussed in automotive, construction, cable and hose end-use applications. 1 ref.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.827830

Item 159
NEW OPPORTUNITIES FOR THERMOPLASTIC ELASTOMERS. Proceedings of a one-day seminar held Shawbury, 19th April 1996. Shawbury, 1996, paper 3, pp.4. 012

'TPE MEETS ETP', COMOULDING AND COEXTRUSION OF STYRENIC TPE'S WITH ENGINEERING THERMOPLASTICS
Fraser D
Evode Plastics Ltd. (Rapra Technology Ltd.)

A range of thermoplastic elastomer compounds has been developed by Evode Plastics Ltd., which will bond to engineering thermoplastics such as nylon, ABS or polycarbonate using co- or insert moulding or coextrusion. The range, called Evoprene COGEE, based on Shell Chemicals’ Kraton G, is designed for a wide range of applications where TPE/PP combinations are unable to meet the requirements. Details are given of the grades of Evoprene COGEE available, their properties, processing considerations, and possible applications.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.827828

Item 160
Kautschuk und Gummi Kunststoffe 54, Nos.7-8, 2001, p.362-7
German

PHASE MORPHOLOGY AND RELAXATION BEHAVIOUR OF SEBS/PP BLENDS
Vennemann N; Huendorf J; Kummerloewe C; Schulz P Osnabrueck,Fachhochschule

Model styrene-(ethylene-butylene)-styrene block copolymer/PP thermoplastic elastomers were studied and it was shown that mechanical properties, thermal application limits and relaxation behaviour were determined by the phase morphology of the blends. Two methods were used which were developed especially for the characterisation of thermoplastic elastomers. Intermittent stress-strain measurements were used to describe the strain recovery behaviour of the material. The relaxation behaviour could be studied by thermal scanning stress relaxation tests which also allowed conclusions to be drawn concerning the phase morphology. 8 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.827643
HIGH PERFORMANCE DECORATION WITH POLYAMIDE FILMS
Lohmar J; Beyer M
Degussa-Huels AG
(SPE)

The use of polyamide-12 and polyamide-12 thermoplastic elastomers for decorative and protective film applications is discussed. Decoration may be applied to the film by offset, screen, and tamp printing, by computer-controlled application by electrostatic or inject processes, and by sublimation printing. The film may be treated to enhance bonding, using processes including grinding, flame treatment, and corona or plasma treatment.

NOVEL THERMOPLASTIC ELASTOMERS (TPES) FOR AUTOMOTIVE INTERIOR APPLICATIONS: TPES WITH IMPROVED MOLDED SURFACE APPEARANCE AND REDUCED FOGGING
Jacob S; Lawrence G
Advanced Elastomer Systems LP
(SPE)

Thermoplastic vulcanisates, for the manufacture of automotive components by injection moulding with in-situ vulcanisation, were developed with additives to control the rheology and crystallisation rate, with the objective of improving surface appearance and reducing fogging. The materials were characterised by differential scanning calorimetry, by evaluation of the surface appearance of injection moulded parts, and by measurement of physical properties, fogging, and odour. Fogging, measured at 100 °C for 16 h was very low (0.7-1.3 mg). The enhanced surface appearance was attributed to the unique melt flow properties. 15 refs.

TPE COMPOUNDS PROVIDE NEW OPTIONS FOR MEDICAL TUBING

The Thermoplastic Elastomer Division of Teknor Apex has developed three new thermoplastic elastomer compounds for use in the manufacture of medical tubing. They are designed as replacements for latex and to avoid the plasticisers commonly used in PVC. The compounds are additions to the Monoprene line of styrenic block copolymer TPEs. Characteristics and properties are described for grades of Monoprene TPE MP 1580L1, MP 1871-R, and MP 1848. TEKNO APEX CO.

ALCRYN MPR, THE WORLD'S ONLY MELT-PROCESSABLE RUBBER

Advanced polymer data sheets are presented for Alcryn MPR, a melt processable rubber from Advanced Polymer Alloys, a division of Ferro Corp. The material is offered as an alternative to soft thermoplastic elastomers and thermoset rubbers. It is a true rubber, based on a partially crosslinked chlorinated olefin interpolymer alloy, and is designed for the manufacture of rubber parts with high productivity on thermoplastic processing equipment, processing like a thermoplastic whilst behaving like a rubber. Details are given of the product line which consists of four series, its properties and applications.

SARLINK THERMOPLASTIC ELASTOMERS

Product data sheets and a press release from DSM Thermoplastic Elastomers give information relating to the
Sarlink 5000 series of products. The grades are highly engineered thermoplastic elastomers for use in demanding applications. Product data sheets, including property data, processing and handling information are given for Sarlink XRD-5755B4, Sarlink X-5765B4, Sarlink X-5775B4, Sarlink 5755B4, Sarlink 5765B4, and Sarlink 5775B4. The Sarlink 5000 series is reported to represent a significant innovation for a number of markets including auto sealing systems and building and construction.

Item 167
Dallas, Texas, 6th-10th May, 2001, paper 298
EFFECT OF PROCESSING PARAMETERS ON BOND STRENGTH FOR MULTICOMPONENT INJECTION MOLDING
Mehta S R; Parikh D R
Advanced Elastomer Systems LP (SPE)

The development of thermoplastic vulcanisates (TPVs), capable of bonding to thermoplastic substrates without the use of primer or adhesive is reviewed. The first materials were developed to bond to polyamide in the multicomponent injection moulding process. Subsequently, materials were developed that were capable of direct bonding to polyester or polyamide fibre, and the latest developments included TPVs capable of bonding to engineering plastics such as polycarbonate and ABS. Insert and two-component moulding is described. The influence of processing parameters on the bond strength between TPV and substrate was investigated, and for fibre-reinforced thermoplastics, it was established that high injection speed, and high mould and melt temperatures during the substrate moulding enhanced the bond strength. This was attributed to the creation of a suitable surface for the subsequent TPV bonding. 6 refs.

Accession no.825390

Item 168
Dallas, Texas, 6th-10th May, 2001, paper 296
ROBOTIC EXTRUSION, A NOVEL TECHNOLOGY FOR COMPLEX SEALING PROFILES USING SANTOPRENE THERMOPLASTIC RUBBER
Peterson D E; van Meesche T
Advanced Elastomer Systems LP; Advanced Elastomer Systems NV/SA (SPE)

A system for the extrusion of soft profiles onto, or around, rigid substrates is described. A thermoplastic rubber with very low melt viscosity, developed for the process, is fed by a flexible, high pressure, heated hose from an extruder to a die controlled by a 6-axis robot, which applies the required profile to a rigid substrate. Bonding to the substrate is by mechanical locking, a bonding agent, or welding.

Accession no.825379

Item 169
Dallas, Texas, 6th-10th May, 2001, paper 294
PHASE MORPHOLOGY AND CURE STATE CHARACTERIZATION OF SOFT THERMOPLASTIC VULCANIZATES (TPVS) BY USING ATOMIC FORCE MICROSCOPY (AFM)
Chung O; Nadella H P
Advanced Elastomer Systems LP (SPE)

The phase morphology and degree of cure of soft thermoplastic vulcanisates were studied using tapping mode atomic force microscopy. The morphology results were in good agreement with those obtained by scanning and transmission electron microscopy, with good contrast between rubber, filler and plastic. Curing was determined from phase lag measurements, and was in good agreement with oil weight gain data and bulk modulus data at 100% elongation. 9 refs.

Accession no.825392

Item 170
Dallas, Texas, 6th-10th May, 2001, paper 283
CONDUCTIVE TPO FOR ELECTROSTATIC PAINTING
Babinec S; Lewis R; Cieslinski R
Dow Chemical Co. (SPE)

Electrically conductive blends of polypropylene, ethylene-octene copolymer elastomer and conductive carbon were prepared for the production of moulded parts to be painted by electrostatic spraying. The materials were characterised by measurement of electrical conductivity, and morphology was studied using transmission electron microscopy. Continuity of the elastomer phase was established by determining the weight change after extraction in toluene. The electrical conductivity to give optimum paint transfer was determined. The observed percolation conductivity was only in agreement with theoretical predictions when sufficient time was allowed for the fillers to form a network, and double percolation required that the phase containing the conductive filler must be both singularly percolated and continuous. 22 refs.

Accession no.825379
Item 171
Dallas, Texas, 6th-10th May, 2001, paper 242
WELDING OF A THERMOPLASTIC ELASTOMER
Tuchert C; Bonten C; Schmachtenberg E
Essen, University (SPE)
The influence of welding parameters on the welded joints of thermoplastic elastomers were investigated. The elastomers were ethylene-propylene-diene terpolymer/polypropylene blends with different Shore hardnesses. Hot plate welding was used, and the joints characterised by tensile testing, and by optical and scanning electron microscopy. The welded joints were characterised by a low strain and a different distribution of the hard and soft components compared with the parent material. 10 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.823741

Item 172
Amsterdam, Netherlands, 6-7 March 2000, Paper 18
FAST, PRECISE QUALITY CONTROL ANALYSIS OF TPE
Burhin H G
Alpha Technologies (Rapra Technology Ltd.; European Plastics News)
Alpha Technologies’ RPA2000 dynamic tester was used to evaluate a range of thermoplastic elastomers and was shown to be extremely sensitive to product quality. The thermoplastic elastomers could be successfully tested on the automated RPA if samples were prepared in disc form. Automatic sample loading and unloading removed the operator influence and ensured high testing throughput.
BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE
Accession no.820665

Item 173
Amsterdam, Netherlands, 6-7 March 2000, Paper 17
SPECIAL TECHNOLOGIES FOR INJECTION MOULDING OF TPEs
Pokorny P
Engel Maschinenbau GmbH (Rapra Technology Ltd.; European Plastics News)
Special technologies for injection moulding of thermoplastic elastomers are discussed, including multi-component injection moulding, co-injection, back moulding of films or textiles, and foaming of thermoplastic elastomers with the MuCell (micellar foaming) process. 1 ref.
AUSTRIA; EUROPEAN UNION; WESTERN EUROPE
Accession no.820664

Item 174
Amsterdam, Netherlands, 6-7 March 2000, Paper 14
FLOCK AND DECORATIVE TAPE FOR APPLICATION TO TPE FOR AUTOMOTIVE SEALS
Castonguay R
Dorrie International (Rapra Technology Ltd.; European Plastics News)
A tape product was developed which could be bonded in-line during extrusion of thermoplastic elastomer (TPE) automotive seals to produce accurately positioned flocked areas. Embossed PVC or embossed thermoplastic olefin tapes that could be in-line bonded to TPE extrusions were also developed, along with fabric tapes for seal decoration. The characteristics of the tapes, techniques for their application and properties of the parts made with them are discussed.
USA
Accession no.820661

Item 175
Amsterdam, Netherlands, 6-7 March 2000, Paper 12
RECENT ADVANCES IN THERMOPLASTIC VULCANIZE TECHNOLOGY
Morin P; Batra J; Politis J
Teknor Apex Co. (Rapra Technology Ltd.; European Plastics News)
The properties of new generation thermoplastic vulcanisate (TPV) grades based on proprietary Teknor Apex technology, DVA 7100-64 and DVA 7100-73, were compared with those of conventional commercially-available TPVs. DVA 7100 was shown to exhibit non-hygrosopicity and better colourability than conventional TPVs and slightly better elevated temp. compression set when compared with other commercially-available non-hygrosopic and improved-colourability TPVs. The shear thinning behaviour of DVA 7100 was similar to that of conventional TPV. The new products met the requirements of automotive accelerated exterior weathering. 7 refs.
USA
Accession no.820659

Item 176
Amsterdam, Netherlands, 6-7 March 2000, Paper 7
THERMOPLASTIC ELASTOMERS OF NITRILE RUBBER AND NYLON 6
Mehrabzadeh M; Delfan N
Iran, Polymer Institute (Rapra Technology Ltd.; European Plastics News)
The effects of different systems of curing (dicumyl peroxide-cured, sulphur-cured and phenolic-cured) and of
the amount of curing agent on the mechanical properties, thermal behaviour and morphology of NBR/nylon-6 thermoplastic elastomers were investigated. At an NBR/nylon-6 60/40 composition, dynamic crosslinking had a significant improvement on tensile properties, hardness, swelling in oil, permanent set and high temp. performance. It was shown that the phenolic curing system was better than the other systems tested. 6 refs.

IONIC THERMOPLASTIC ELASTOMERS: A REVIEW
Antony P; De S K
Indian Institute of Technology
A review of the literature on ionic thermoplastic elastomers is presented, covering synthesis of ionomers, structure of ionomers, elastomeric ionomers (sulphonated elastomeric ionomers, carboxylated elastomeric ionomers), block copolymer ionomers, ionomic polyblends, and applications. 148 refs.

Item 177
Amsterdam, Netherlands, 6-7 March 2000, Paper 4
USE OF CHEMICAL ADDITIVES TO PROTECT SBS RUBBERS AGAINST OZONE ATTACK
Moakes C A
Bayer AG
(Rapra Technology Ltd.; European Plastics News)
A compounding approach to protecting styrene-butadiene-styrene thermoplastic elastomers against ozone is described and an explanation is provided of why a protective effect is observed only when certain combinations of additive are used. A combination of enol ether (Vulkazon AFD) with even small amounts of paraffin or microcrystalline wax is shown to provide protection against ozone attack under severe test conditions. 5 refs.

Item 178
Amsterdam, Netherlands, 6-7 March 2000, Paper 2
INNOVATIVE NEW APPLICATIONS FOR THERMOPLASTIC ELASTOMERS ON ESTER BASE
Creemers H M J C
DSM Engineering Plastics
(Rapra Technology Ltd.; European Plastics News)
Thermoplastic elastomers based on polyesters, such as DSM’s Arnitel, are discussed with particular reference to markets, chemistry and morphological properties, general properties, typical applications, applications in airbag covers or deployment doors, and film applications, e.g. roofing membranes and surgical drapes and gowns.

Item 179
Journal of Macromolecular Science C
41, No.1-2, 2001, p.41-77

Item 180
European Rubber Journal
183, No.7, July/August 2001, p.16-7
ALL-TPE WEATHERSEALS ALMOST HERE?
White L
Thermoplastic elastomer markets are developing strongly as technology improves and niche applications benefit from advantages. In Japan, Mitsubishi Motors uses TPEs for boot and bonnet seals. TPEs have also replaced PVC in belt-line seals and TPE door seals are in development. However, in Europe, an all-TPE sealed car will not appear within the next ten years, it is claimed. GKN Automotive has set itself a deadline of 2005 for all CVJ boots to be in TPE. Optatech has a new version of its acrylic TPE which retains good oil resistance at temperatures of up to 125°C, an improvement over the previous temperature of 100°C. Kraiburg is commercialising a TPV material called E2 which has excellent oil resistance and outstanding heat and ageing resistance.

Item 181
(Rosta (TO)), c. 2001, pp.2. 29 cms.12/6/01
MARIS COMPOUNDING TECHNOLOGY. THERMOPLASTIC ELASTOMERS COMPOUNDING LINE
Maris SpA
Outputs from extrusion compounding lines for thermoplastic elastomers are indicated with respect to compounding technology from Maris SpA. Extruder diameters from 40 to 177 mm with two flight geometry are used to compound SEBS, SBS, polyolefin elastomers, EPDM, and for reactive as well as mechanical extrusion blending. The lines are illustrated for the compounding of SEBS and SBS, and for the reactive extrusion of thermoplastic elastomers.

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SOFT GRIP OVERMOULD TAKES THE ABUSE

An engineered thermoplastic elastomer, called Estagrip, has been developed by BFGoodrich Performance Materials, for use as a durable soft-grip over rigid substrates. This thermoplastic elastomer has almost three times the tear strength of other soft-touch elastomeric materials and adheres well to various rigid substrates. Some innovative design and soft-touch overmoulding tricks are illustrated using, as an example, a letter opener made from two different grades of Estagrip.

GOODRICH B.F., PERFORMANCE MATERIALS USA
Accession no.818573

Thermoplastic Elastomers - Recent Developments and the European Market
Dufton P W
Rapra Technology Ltd.

A market analysis is presented of thermoplastic elastomers with reference to the European markets. The major materials considered are styrenic block copolymers, thermoplastic polyolefins, thermoplastic vulcanisates, thermoplastic polyurethanes, copolyesters and copolyamides. Each material is discussed in terms of materials developments, including materials competing with them, trends in technological developments, properties, processing characteristics, and supply and demand trends. End-use markets examined include the automotive industry, wire and cable industries, footwear, general mechanical goods, adhesives and sealants, medical products, and other uses such as polymer modification and coated fabrics.

EUROPE-GENERAL
Accession no.817339

POLYOLEFIN THERMOPLASTIC ELASTOMERS
Lopez M A; Arroyo M
Instituto de Ciencia y Tecnologia de Polimeros

An examination is made of the properties, processing and applications of polyolefin thermoplastic elastomers, with particular reference to compositions based on EPDM/PP blends, and the influence of the properties of the individual blend components on those of the polyolefin elastomers is discussed. Types of additives used in such elastomers are also reviewed. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; USA; WESTERN EUROPE; WESTERN EUROPE-GENERAL
Accession no.814830

BROADER OPTIONS WITH NEW BONDABLE TPVS
Torti K

The Santoprene B100 Series of thermoplastic vulcanisates from Advanced Elastomer Systems enables designers to chemically bond a soft-touch thermoplastic elastomer with a wider variety of engineering plastics. Applications include grips for personal care items, power tools and lawn equipment. The bond between Santoprene B100 TPV and ETP is durable in a wide variety of solvents in extreme exposures. Bonding performance data are presented.

ADVANCED ELASTOMER SYSTEMS LP USA
Accession no.814457

The effects of the PVC/plasticiser/NBR composition on the properties of thermoplastic elastomers of PVC/NBR blends were investigated. The plasticiser employed was dioctyl phthalate and the properties investigated included Shore A hardness, plasticiser migration, weight loss, tensile strength and elongation at break. It was found that by using appropriate experimental design, it is possible to model the data obtained and produce contour plots to map the properties as a function of blend formulation. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.813905

NEW OPPORTUNITIES FOR HYDROGENATED SBS ELASTOMERS
Gobbi C
EniChem Elastomeri

Following a review of the characteristics of styrene block copolymer thermoplastic elastomers in general, an examination is made of the properties and applications
of styrene-ethylene butylene-styrene block copolymers. The market for these elastomers is discussed, and statistics are presented for world demand by region and application sector in 1998-2000 with forecasts to 2005. Investments by EniChem in styrene block copolymer production are also reported.

ENICHEM
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE; WORLD
Accession no.812760

Item 188
Journal of Applied Polymer Science
80, No.2, 11th April 2001, p.148-58
CHARACTERIZATION OF THE DEFORMATION BEHAVIOR OF DYNAMIC VULCANIZATES BY FTIR SPECTROSCOPY
An Huy T; Luepke T; Radusch H-J
Halle, Martin-Luther-Universitat
Thermoplastic elastomers based on polypropylene (PP) and ethylene-propylene-diene terpolymer (EPDM) were prepared using different rubber:thermoplastic ratios with a constant crosslinking agent content, and also using a constant rubber:thermoplastic ratio with different crosslinking agent concentrations. Samples were studied using Fourier transform infrared spectroscopy whilst subjected to uniaxial tensile stress. Orientation in the dispersed phase (EPDM) was higher than in the PP matrix phase, and increased continuously. The orientation in the crystalline PP phase increased during stress relaxation, whilst the orientation of the EPDM phase simultaneously decreased. On unloading, the orientation recovery in the EPDM phase was complete, whilst recovery in the PP phase was only reversible at low strains. The critical point, at which the elastic deformation was lost, corresponded to the minimum in the orientation function curve. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.810735

Item 189
Kunststoffe Plast Europe
English; German
HIGH-GRADE INSULATION
Bertels A
Elastogran GmbH
The automotive engineering sector, in particular, calls for cables that are wear-resistant, flexible at low temperatures and insensitive to chemicals. Apart from this, the materials employed are required to be halogen-free and recyclable. Thermoplastic PU (TPU) fulfils these requirements in an ideal manner. TPU belongs to the thermoplastic elastomers product class. It attains virtually the same level of elasticity as crosslinked elastomers (rubber) while simultaneously offering the advantages that it can be processed like a thermoplastic and coloured as required. Demand for TPU in the European cable industry has been increasing by more than 10% per annum for several years. Comparable growth rates can be expected for the future too, given the growing requirements being placed on cable sheathing and the particular properties of TPU as a cable material. (Translated from Kunststoffe 91, 2001, 2, p.88-90).

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.809457

Item 190
Shirley, Ma., c.2001, pp.4. 29 cms. 21/2/01
THERMOPLASTIC RUBBER SYSTEMS INC.
Thermoplastic Rubber Systems Inc.
The Nex generation of thermoplastic elastomers from Thermoplastic Rubber Systems Inc. is presented. The materials are available in hardness ranges from Shore 3A to 50D and in natural (colourable), black, or any specific custom colour that best fits the application. The product range includes NexPrene EPDM/PP, NexFlex SEBS or SEEPS/PP, NexLink EPDM/SEBS/polyacrylate, nitrile proprietary alloys in a PP matrix, and NexTrile nitrile/PP fully vulcanised blends. Separate technical data sheets are included for NexPrene general purpose grades, and for oil and heat resistance data of NexPrene.

USA
Accession no.808389

Item 191
Dearborn, Mi., 2nd-4th Oct.2000, p.287-300
SILOXANE MASTERBATCHES AS SCRATCH RESISTANCE ADDITIVES FOR TPO COMPOUNDS
Chappelle J; Masalovic M; Ryan K; Musser K
Dow Corning Corp.
(SPE, Detroit Section)
The influence of solid UHMW siloxane masterbatches on the scratch resistance of PP TPOs is described. Aspects covered include what are UHMW siloxane masterbatches, why TPOs are used in the automotive and appliance industries, why is the scratch resistance of TPOs becoming an increasing concern, how do UHMW siloxane masterbatches help, scratch resistance performance of Dow Corning MB50-321 and MB50-011, and how does Dow Corning MB50-321 and MB50-011 affect the other properties of TPO. 1 ref.

USA
Accession no.807836

Item 192
Dearborn, Mi., 2nd-4th Oct.2000, p.209-14
ENGINEERED POLYOLEFINS WITH ENHANCED SURFACE DURABILITY

Lau E; Srinivasan S
Solvay Engineered Polymers
(SPE,Detroit Section)

Thermoplastic polyolefins are widely used in automotive exterior and interior applications due to their excellent balance of performance, processibility, environmental friendliness and economics. While their use in large exterior parts such as bumper fascia, claddings, rocker panels and the like is almost ubiquitous, their utilisation in interior applications displacing so-called engineering plastics has also been exponentially increasing. Most exterior components are painted, not only for aesthetic reasons such as matching body colours, gloss and weatherability, but also for protecting the polymeric substrate from sunlight (in the case of RIM urethanes) or wear (in the case of polyolefins). A very important function of the coating layer is to protect the underlying substrate from marring, scratching and abrasion. Some of the primary attractions of polyolefins are that they are very easy to colour and are inherently very photo-oxidatively stable, imparting excellent weatherability. However, one drawback of polyolefins is their relatively poor resistance to abrasion and scratching. In order to mitigate these effects, unpainted parts are often imparted with a superficial grained surface. This inherently suppresses the gloss of the finished part, constraining the design parameters for such vehicles. The development of olefinic materials with superior surface durability would go a long way towards eliminating the need for paints, which constitute up to 70% of the cost of making a painted part. Similarly, such olefinic materials with inherent lower gloss and superior scratch resistance would accelerate the displacement in interior applications of polymeric materials such as ABS, PC and PVC, all of which have decent surface durability and require coating for gloss control. 10 refs.

USA

Accession no.807825

Item 193
Plastics Technology
46, No.12, Dec.2000, p.52/7
HOW TO EXTRUDE COPOLYESTER TPE FILM
Fairley G; Conkey J
DSM Engineering Plastics

It is explained that multiplying niche markets are tempting increasing numbers of extruders of specialty blown and cast films and coatings, to try copolyester TPE resins. This article discusses the extrusion of copolyester TPE film, and includes information on applications and markets, general and rheological properties, extruder considerations, cast film, blown film, and extrusion coating.

USA

Accession no.804719

Item 195
Plastics Technology
46, No.11, Nov.2000, p.32/3
LOTS OF NEW TPE’S DEBUT

This article provides brief information on each of several new thermoplastic elastomers which have been recently launched onto the market. Included in this list are: “MultiFlex A6202 MR” from Multibase Inc., “Sequel 2325” from Solvay Engineered Polymers, “Aclryn” grades from Advanced Polymer Alloys, “Santoprene TPE X8211-55B100” from Advanced Elastomer Systems, “Elastollan” grades from BASF Corp., “Avalon” TPU from Huntsman Polyurethanes, and “Sarlink 5000” TPVs from DSM Thermoplastic Elastomers.

MULTIBASE INC.; SOLVAY ENGINEERED POLYMERS; ADVANCED POLYMER ALLOYS; POLYONE CORP.; ADVANCED ELASTOMER SYSTEMS; BASF CORP.; HUNTSMAN POLYURETHANES; DSM THERMOPLASTIC ELASTOMERS; US,FOOD & DRUG ADMINISTRATION

USA

Accession no.804688
RHEOLOGY OF TPV'S
Steeman P; Zoetelief W
DSM Research BV
(SPE)
The rheological properties of the melts of six commercial polypropylene/ethylene-propylene-diene terpolymer/oil dynamically vulcanised thermoplastic vulcanisates were investigated using parallel plate rheometry, capillary rheometry and creep measurements in shear at various stress levels, at 195°C. The rheological properties were highly dependent upon the applied stress. At the lowest stress levels, an elastic network of rubber particles was dominant. Flow occurred at intermediate stress levels, with a viscosity which was heavily dependent upon the rubber content. At the highest stress levels the dominant factor was the influence of the polypropylene matrix phase. 5 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.803837

CLEAR AND HIGH HEAT RESISTANT TPES
Lu Y M; Kutka J
GLS Corp.
(SPE)
The development of soft, clear thermoplastic elastomers with sufficient heat resistance for repeated boiling is discussed. The compositions were based on styrene block copolymers. The materials were compounded by screw extruder and samples prepared by injection moulding. The materials were assessed by haze measurements, and by a dynamic mechanical analysis technique to estimate service temperature. The influence of the oil used in the composition, and of the copolymer on the resulting service temperature is discussed. Easily processed compounds with high service temperatures were developed. 3 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.803831

THERMOPLASTIC ELASTOMERS IN PRESSURE SENSITIVE ADHESIVES WITH STABLE TEMPERATURES
Vermunicht G; Southwick J G
Shell Research SA
Since their introduction 30 years ago, styrene block copolymers (SBC) have had wide use in the formulation of hot melt adhesives and jointing compounds. However, these thermoplastic elastomers are inclined to decompose and separate through the effects of UV light and oxidation. There have recently become available on the market SBC types with hydrogenated double bonds in the isoprene or butadiene elastomer centre block. These rule out the disadvantages above and enable the formulation of pressure sensitive hot melt adhesives that are stable at high temperatures, for example. 2 refs.
BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.803781

ANALYSIS OF ADHESIVE PROPERTIES OF DIFFERENT ENGINEERING THERMOPLASTICS TO ELASTOMERS BY A TWO-SHOT INJECTION MOLDING PROCESS
Patel S; Makadia C; Guan Q; Mehta S; McCarthy S P
Massachusetts,University
(SPE)
Adhesion between a hard core and the soft skin of materials intended for automotive interior applications, produced using the two-shot injection moulding process, was investigated. Filled polypropylene and two thermoplastic polyolefins (containing ethylene, propylene, and EPDM) were tested with two thermoplastic elastomers (TPE) (containing ethylene-propylene rubber, ethylene, propylene and EPDM). In addition, polycarbonate (PC), acrylonitrile butadiene styrene (ABS), and an alloy of PC and ABS were tested with thermoplastic polyurethane. Bond strengths were determined by shear and peel testing. In the first group the strongest bond was between polypropylene and a lower density TPE containing ethylene-propylene rubber, ethylene and propylene. The bond strength could be increased by adding skin material to the core material and/or by adding core material to the skin material, resulting in increased compatibility. In the second group the materials could not be ranked as no adhesive failure was observed.
USA
Accession no.803373

THERMOPLASTIC ELASTOMER CUTS COSTS
Teknor Apex has introduced a thermoplastic elastomer, which exhibits improved performance over flexible PVC materials and is 20 to 40% cheaper than other thermoplastic elastomers for cord jacketing applications. Flexalloy 9604-75 is a vinyl-based elastomer having a hardness rating of 78 Shore A, an elongation of 285% and a brittle point of -47°C. It is suitable for outdoor
applications, such as extruded cable jacketing and insert moulded electrical plugs.

TEKNOR APEX
ASIA
Accession no.801467

Item 201
Orlando, Fl., 7th-11th May, 2000, paper 405
FOAMING OF THERMOPLASTIC ELASTOMERS WITH WATER
Sahnoune A
Advanced Elastomer Systems LP
(SPE)
A thermoplastic elastomer, a blend of polypropylene and crosslinked EPDM rubber prepared by dynamic vulcanisation, was foamed by screw extrusion using water as the physical blowing agent. The average melt temperature was 174°C, and water was injected at 7-10 MPa. The influence of water concentration and processing conditions on the foam density, cell nucleation and foam structure were investigated. It was shown that thermoplastic elastomers foamed in a manner very similar to that of conventional polymers, and low foam densities were achieved. 11 refs.

USA
Accession no.799920

Item 202
Kunststoffe Plast Europe
WELDING THERMOPLASTIC ELASTOMERS
Bonten C; Schumachtenberg E; Tuchert C
IK2
The welding of thermoplastic elastomers is discussed with reference to a research project currently underway at IK2. The structural changes in the welding seam region produced by the welding process influence the characteristics of the weld joint. So far, it is not clear how the domain structure of a TPE block copolymer butt or the phase distribution of a TPE blend is formed along the contact surface of a butt weld. These relationships are being examined systematically, and interested parties are invited to participate in the research work.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.798576

Item 203
Orlando, Fl., 7th-11th May, 2000, paper 356
PROPERTIES OF AN OIL RESISTANT TPV
Cook S; Patel J; Tinker A J
Tun Abdul Razak Research Centre MRPRA
(SPE)
Thermoplastic vulcanisates (TPV) are blends of a thermoplastic with an elastomer which has been vulcanised during blending. A TPV consisting of thermoplastic epoxidised natural rubber (TPENR) (a blend of polypropylene and epoxidised natural rubber) is described. TPENR blends of 65 Shore A hardness were prepared and characterised by measurement of tensile properties, tensile fatigue, and weathering, heat, oil, light and ozone resistance. The properties compared well with those of other TPVs, and the oil resistance was comparable to that of NBR. The material exhibited excellent heat resistance, with good retention of properties following heat treatment at 100 and 150°C for extended periods. Good weathering and ozone resistance was also observed. 15 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.799142

Item 204
Orlando, Fl., 7th-11th May, 2000, paper 294
CONDUCTIVE THERMOPLASTIC ELASTOMERS
Dahman S J; Holzbauer T; Nelson B
RTP Co.
(SPE)
The composition and applications of electrically conducting thermoplastic elastomers are briefly described. The most common conductive additives are carbon and metal powders. Carbon and metal fibres of used to a lesser degree, and recent developments include the use of intrinsically conductive polymers. Thermoplastic elastomers were blended with various conducting additives using twin-screw extruder, and test specimens produced by injection moulding. The materials were characterised by measurements of tensile properties, hardness, and volume and surface resistivity. Thermal stability was studied by ageing samples in air at 100°C. Percolation curves for common elastomers and conductive fillers are given. 6 refs.
USA
Accession no.799410

Item 205
Rubber and Plastics News 2
22, No.2, 2000, p.4
HUNTSMAN UNVEILS TPU ELASTOMERS FOR FOOTWEAR
McNulty M
Huntsman Polyurethanes has developed new high performance thermoplastic PU elastomers it believes could dramatically alter the high-quality footwear market. The new families of soft TPU deliver excellent physical performance for footwear, as well as superior surface definition, part finish, slip resistance and durability. The materials are part of Huntsman’s Avalon group of TPUs.
LAUNCH OF NEW LINE MARKS U-NOVA FORAY INTO TPE HOSE
Wenger R

U-Nova Hose & Duct has taken its first step into the thermoplastic hose market with the introduction of two products for industrial and agricultural applications. The line is part of 1m US dollars in industrial improvements the company announced in June, along with the purchase of automated machinery for its Lawrence Industries division to produce the hoses. The hoses, composed of thermoplastic rubber and proprietary materials, allow U-Nova to serve customers who need thermoplastic hose with better abrasion resistance, superior flexibility and a broader temperature range.

U-NOVA HOSE CORP.

ONE FOR THE LADIES
Smith C

At the heart of the Bioform bra design is a two-component plastic moulded support structure comprising a rigid plastic armature, which takes the place of the underwire in a traditional bra, overmoulded in soft flexible TPE to make it more comfortable for the wearer. The problem for designer PDD was there was no specific data on which to build on. On the structural side, there was only the shape of a steel wire from an existing bra to work from. SMP Multi-Shot made one mid-range pair of prototype tools. Highly isotactic PP from Solvay was selected for the rigid core and a specially formulated TPE from Kraiburg for the flexible component. Initial sales levels of the Bioform bra, which went on sale in October, have been good.

PDD

DECORATING TPES USING HEAT TRANSFERS
Wegelin R; Masure G

Thermoplastic elastomers can be decorated using heat transfers. The process is based on heat and pressure which makes it possible to create a durable union of the TPE part and the heat transfer label. A variety of surface effects can be obtained which allow the user to produce almost any design or decorative effect that is required.

REGULATIONS AND STANDARDS IMPACTING USES OF THERMOPLASTIC ELASTOMERS
Rader C P; Pfeiffer J E

A review is presented of the regulations, standards and specifications which affect the marketing and use of thermoplastic elastomers. These are reported to be very similar to those impacting conventional thermoset rubbers. The definition of regulations, standards and specifications is given, and bodies concerned with the development of such are identified. 22 refs.

DECORATING TPES USING HEAT TRANSFERS
Wegelin R; Masure G

Advanced Elastomer Systems LP

Thermoplastic elastomers can be decorated using heat transfers. The process is based on heat and pressure which makes it possible to create a durable union of the TPE part and the heat transfer label. A variety of surface effects can be obtained which allow the user to produce almost any design or decorative effect that is required.

USA

ACCESSION NO.795186

Item 209

NEW TPE BONDING TECHNOLOGY AND VARIOUS OVERMOLDING PROCESSES COMBINE FOR CREATIVE, COST-EFFECTIVE TPV APPLICATIONS
Tan O H C; Mehta S

Advanced Elastomer Systems LP

This paper outlines advances in the development and use of new alloys which allow thermoplastic vulcanisates (TPVs) to heat-fuse with numerous substrates including ABS, nylon, polycarbonate, PC/ABS, ASA, PS and PMMA in addition to polyolefinic substrates. Additional information is provided on key TPV processing characteristics which accommodate these new bonding characteristics in insert moulding, two-shot-plus moulding, co-injection moulding and coextrusion, to further expand the creative and cost-effective use of TPVs. 6 refs.

USA

ACCESSION NO.794167

Item 210

REGULATIONS AND STANDARDS IMPACTING USES OF THERMOPLASTIC ELASTOMERS
Rader C P; Pfeiffer J E

Advanced Elastomer Systems LP

A review is presented of the regulations, standards and specifications which affect the marketing and use of thermoplastic elastomers. These are reported to be very similar to those impacting conventional thermoset rubbers. The definition of regulations, standards and specifications is given, and bodies concerned with the development of such are identified. 22 refs.

USA

ACCESSION NO.794150

Item 211

DECORATING TPES USING HEAT TRANSFERS
Wegelin R; Masure G

Advanced Elastomer Systems LP

Thermoplastic elastomers can be decorated using heat transfers. The process is based on heat and pressure which makes it possible to create a durable union of the TPE part and the heat transfer label. A variety of surface effects can be obtained which allow the user to produce almost any design or decorative effect that is required.

USA

ACCESSION NO.794150
MULTI LAYER MOLDING EMPLOYING THE ESTAGRIP TPE SYSTEMS
Martello G
Goodrich B.F.,Co.,Performance Materials
(ACS,Rubber Div.)

The performance is evaluated of the use of the EstaGrip thermoplastic elastomer system in multi-component moulding applications with reference to the provision of substrate-over-mould adhesion to a variety of surfaces, including its use in a glass fibre reinforced thermoplastic polyurethane/unreinforced thermoplastic polyurethane structure. As well as evaluating adhesion properties, its ability to provide an ergonomic soft-feel texture is discussed, together with durability and toughness properties.

USA
Accession no.794149

MULTICOMPONENT STRUCTURAL PLASTIC PART DESIGNS
Banning R; Howarth C; Muhs J
Trimax LLC
(ACS,Rubber Div.)

The incorporation of thermoplastic elastomers in multi-component designs with thermoplastics and structural thermoplastics is examined. This paper is concerned with TPEs from six different classes: SEBS, TPOs, SEBS, MPR, TPB, and TPU. Characteristics of each type of TPE are briefly described, and typical applications are indicated. The advantages and benefits of combining TPEs with other materials in multi-component systems are discussed, with reference to property improvements, aesthetics, ergonomics, adhesion, and cost effectiveness.

USA
Accession no.794144

Bonding of Thermoplastic Elastomers to Plastics during Multi-component Injection Moulding Processes
Mehta M; Verma G; Barry C M F; Stacer R G
Massachusetts,University
(ACS,Rubber Div.)

Results are discussed of an experimental investigation which was carried out to study the development of bond strength between thermoplastic elastomers and conventional thermoplastics during multi-component injection moulding. Representatives from each of the major classes of thermoplastic elastomers were moulded against a range of polar and non-polar thermoplastics using either two-shot or insert injection moulding techniques. Interfacial morphology was characterised through part dissection and compared with contact angles measured at the bonding temperature, as well as other surface properties. Resultant bond strengths were determined using either butt joint or double-lap shear test specimen geometries, and a specific application is considered in which an oil-resistant thermoplastic rubber is bonded to a polycarbonate support ring, in order to evaluate the role of a full range of processing conditions on the resultant bond strength. 15 refs.

USA
Accession no.792470

Item 212
158th. ACS Rubber Division Meeting - Fall 2000.
Conference preprints.
Cincinnati, Oh., 17th.-19th. Oct. 2000, paper 42

Hydrocerol Chemical Foaming and Nucleating Agents
Clariant Masterbatches

Additives in masterbatch or powder form from Clariant for use as chemical foaming agents and nucleating agents are described, with reference to performance and typical applications. Hydrocerol, Activex and Exocerol chemical foaming agents decompose at processing temperatures and form various gases that expand thermoplastics, resulting in a fine cellular structure. Advantages of foaming thermoplastic resins are considered. The use of Clariant’s nucleating masterbatches is said to provide a more regular, fine-celled foam structure. Details are given of standard grades of product, with details of recommended peak processing temperature, addition levels, and applications.

USA
Accession no.791984

Item 215
Canadian Plastics
58, No.8, Aug.2000, p.16-8

SOFT MATERIALS, HARD RESULTS
LeGault M

This article focuses on the processing considerations for injection moulding and extrusion for five major classes of thermoplastic elastomers (TPEs): thermoplastic styrenics (TPSs), thermoplastic polyolefins (TPOs), thermoplastic vulcanisates (TPVs), thermoplastic polyurethanes (TPUs), and finally copolysters (COPE).

ADVANCED ELASTOMER SYSTEMS; MITSUBISHI; BAYER; BASF; DUPONT DOW ELASTOMERS; NRI INDUSTRIES; DSM; GLS CORP.; TEKNOR APEX
CANADA; USA
Accession no.791984
BONDING OF TPVS TO METAL
Van Nieuwenhove E
Advanced Elastomer Systems NV/SA
(Rapra Technology Ltd.)

Thermoplastic vulcanisates combine thermoset properties with the ease of thermoplastic processing. They supply proven performance in many different markets where flexible materials are required, often with significant costs advantages. Applications include weatherstrips, window profiles, roofing membranes, tubes and hoses, pipe seals and a myriad of other applications. Existing TPV materials are described, together with new products and development work in the adhesion onto reinforcement materials and other substrates. Aspects covered include a definition and classification of thermoplastic vulcanisates; the key properties of TPVs, and products and developments in adhesion onto reinforcement materials. 2 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE
Accession no.790032

SEBS-BASED COMPOUNDS
Sipkens K
Wittenburg BV

It is explained that styrene-ethylene/butylene-styrene polymers are thermoplastic elastomers which are finding applications in a range of medical devices and increasingly as replacements for PVC. This article provides an overview of the properties of these materials, and also fully discusses their potential. 7 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.787110

TPV’S FOR WIRE AND CABLE APPLICATIONS
Tan O
Advanced Elastomer Systems

This article provides information on the selection of thermoplastic vulcanisates (TPVs) for wire and cable applications, including a list of electrical properties to take into consideration. Other performance criteria which may affect selection are also mentioned.

BOMBARDIER
USA
Accession no.787801
Advanced Elastomer Systems had undertaken research into the reclamation of engineering thermoplastic elastomers (TPEs) from highly-contaminated scrap, with the view that under less difficult circumstances the reclaim could only improve. This article describes the study in which reclaimed TPE was blended with virgin TPE and a thermoplastic polyolefin.

**Item 222**

**Rubber World**

222, No.2, May 2000, p.30/6

OVERMOLDING AND CO-EXTRUDING MELT-PROCESSIBLE RUBBER ON RIGID SUBSTRATES

Santoleri D; Armour J
Ferro Corp.

Soft-touch materials are frequently used in combination with rigid substrates nowadays, for example in car interiors, hand tools, personal care items, and sporting goods. Manufacturers are challenged to find the best means of joining hard and soft materials. This article looks at traditional methods and also a variety of new processing techniques such as: co-injection moulding, two-shot moulding, insert moulding, and co-extrusion. It also examines the properties of melt-processible rubber (MPR) and describes over-moulding and co-extruding with MPR.

BLACK & DECKER; DYNABRACE; WATERLOO INDUSTRIES; LESUER

USA

Accession no.783683

**Item 223**

**Journal of Adhesion Science and Technology**

14, No.8, 2000, p.1035-55

STRUCTURE, COMPOSITION, AND ADHESION PROPERTIES OF THERMOPLASTIC POLYURETHANE ADHESIVES

Sanchez-Adsuar M S; Martin-Martinez J M
Alicante,University

The results are reported of a study of the composition and hard segment content of a number of commercial thermoplastic PU elastomers (TPUs), as determined by proton NMR spectroscopy, and the influence of the composition on the properties of the TPUs, which are mostly used as adhesives in the footwear industry. Properties of the TPUs were investigated by DSC, wide-angle X-ray diffraction, DMTA and contact angle measurements. Solvent-based adhesives were produced by dissolving the TPUs in 2-butanone and T-peel strength tests were performed on solvent treated PVC/adhesive joints, which revealed that peel strength increased as hard segment content in the TPUs increased. 33 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.783450

**Item 224**

**Indian Rubber Journal**

Vol.45, Jan./Feb.2000, p.93

NEW GRADES OF POLYOLEFIN ELASTOMERS INTRODUCED

DuPont Dow Elastomers has expanded its line of Engage polyolefin elastomers with the introduction of two new grades, it is announced. Engage 8842 is said to offer exceptional properties of ultra-low density elastomers, and is a high performance 0.857 g/cc ethylene-octene copolymer grade with a 1 melt index. Engage 8130 has been developed especially to enhance flow properties. It is a 13 melt index, 0.864 g/cc ethylene-octene copolymer which allows for thin-walling of parts with improved processability. The company’s plans to increase capacity of its Engage polyolefin elastomers are reported, and include the tripling of production capacity by incremental expansions at its Freeport plant and the construction of a new 300 million pound/year facility to be located in the US Gulf Coast.

DUPONT DOW ELASTOMERS

USA

Accession no.778530

**Item 225**


Durango, Co., 13th-16th June 1999, p.171-8

APPLICATION OF RADIAL SIS POLYMERS TO HOT MELT PRESSURE SENSITIVE ADHESIVES

Komatsuzaki S
Nippon Zeon Co.Ltd. (TAPPI)

Advantageous features of radial SIS polymers for hot-melt pressure-sensitive adhesive applications are reported including low melt viscosity, thermal stability, to form adhesives with high holding power, ability to form adhesives with low melt viscosity and high peel adhesion, and antiblocking performance of pellet. Two developmental SIS polymers are introduced. 7 refs.

JAPAN

Accession no.778180

**Item 226**

**Polymer International**

49, No.6, June 2000, p.591-8

RHEOLOGICAL CHARACTERISATION OF THERMOPLASTIC POLYURETHANE ELASTOMERS

Sanchez-Adsuar M S; Papon E; Villenave J-J
Alicante,University; CNRS
The relationship between the rheological properties and composition of eight PU elastomers was evaluated using a stress-controlled rheometer. The effects of the ratio of hard to soft segments, molecular weight of the macroglycol, and the chain extender size and nature are discussed. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; SPAIN; WESTERN EUROPE
Accession no.777765

Item 227
Macplas International
No.5, May 2000, p.145-6
THERMOPLASTIC ELASTOMERS
This article provides information from two recently-published market reports on thermoplastic elastomers. The first, from the Freedonia Group, looks at forecasted demand for thermoplastic elastomers in the USA. The second provides information from a multi-client report issued by Chemical Market Resources which focuses on end-use markets for thermoplastic elastomers in North America, Europe, and Japan.
FREEDONIA GROUP; CHEMICAL MARKET RESOURCES
EUROPE-GENERAL; JAPAN; NORTH AMERICA; USA
Accession no.777468

Item 228
Journal of Applied Polymer Science
76, No.10, 6th June 2000, p.1590-5
INFLUENCE OF THE SYNTHESIS CONDITIONS ON THE PROPERTIES OF THERMOPLASTIC POLYURETHANE ELASTOMERS
Sanchez-Adsuar M S; Papon E; Villenave J J
Alicante,University; Bordeaux 1,Universite
Thermoplastic PU elastomers (TPUs) of constant composition were prepared by using the prepolymer method and by changing the reaction conditions (prepolymerisation and chain extension time) in order to study the influence of these conditions on the ultimate TPU properties. The TPUs were characterised by GPC, DSC, stress-strain measurements and contact angle measurements. In order to test the adhesion properties of the TPUs, PVC strips were bonded to each other by using TPU solutions and the T-peel strength of the adhesive joints was measured. It was found that, provided a threshold was crossed, the prepolymerisation time markedly affected the ultimate properties of the TPUs (solution viscosity, molec.wt., mechanical and adhesive behaviour), while the chain extension time did not. It was thus possible to prepare TPUs with specific properties by adjustment of the prepolymerisation conditions. 20 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; SPAIN; WESTERN EUROPE
Accession no.772578

Item 229
Polymer
41, No.14, 2000, p.5219-28
PREPARATION AND CHARACTERIZATION OF NOVEL THERMOPLASTIC ELASTOMERS BY STEP/CHAIN TRANSFORMATION POLYMERIZATION
Tzong-Liu Wang; Fang-Jung Huang
Kaohsiung,National Institute of Technology
Polyurethane-polyvinyl thermoplastic elastomers with synthesised using a combination of two-step synthesis and chain polymerisation, the molecular structures being established using Fourier transform infrared and nuclear magnetic resonance spectroscopy, and X-ray diffraction. A free radical initiator, 1,1,2,2-tetraphenyl-1,2-ethanediol, which contains an iniferter group, was used to form a PU iniferter, whilst the monomers acrylonitrile, methyl methacrylate, and styrene were used to form the polyvinyl segments. Tensile testing showed that the copolymers had smaller extensibilities than typical polyurethanes. The improved thermal stability of the elastomers, as determined by thermogravimetric analysis, was attributed to the longer hard segments and to the 1,1,2,2-tetraphenyl-1,2-ethanediol component. Differential scanning calorimetry and dynamic mechanical analysis showed that the copolymers had microphase-separated structures and possessed elastomeric properties. 17 refs.
TAIWAN
Accession no.771788

Item 230
Philadelphia, Pa., 28th-29th Sept.1999, p.236a-236j
TPE AND TPO COMPOUNDING - REVIEW AND APPLICATIONS
Sipsas J P
D.I.S.Tech Group
(SPE, Thermoplastic Elastomers Special Interest Group; SPE,Philadelphia Section)
A thermoplastic elastomer (TPE) is a soft, flexible material providing the performance characteristics and requirements of thermoset rubber, but the processing benefits and case of use of traditional thermoplastics such as PE, PP, polycarbonate, PS and PVC. Products made of TPEs may be manufactured using conventional processing methods and machinery such as injection moulding, extrusion film processing, blow moulding and others. Traditional TPEs are known as two phase systems. Essentially, a hard thermoplastic phase is coupled mechanically or chemically with a soft elastomer phase, resulting in a TPE with the combined properties of the two phases. Traditional classes of TPE are styrene, polyolefins, copolysters, PU and polyamides. New TPE entrants are reactor TPO, metallocene-catalysed polyolefin plastomers and elastomers. Thermoplastic elastomers offer the following advantages compared to thermoset rubber: lower fabrication costs, shorter
processing times, lower energy consumption, fully recyclable in-process scrap and they are more environmentally friendly. However, thermoplastic elastomers have some disadvantages, such as drying is required for some products, and high volumes are required to achieve desirable economics. Compounded TPE and TPO are produced by mechanically blending a soft phase (SEBS, SBS, EPDM) with a hard phase (PP, PE, PS, etc), in the presence of other additives. These specific compounded products, their manufacturing and applications are discussed. 4 refs.

USA
Accession no.771584

Item 231
Philadelphia, Pa., 28th-29th Sept.1999, p.221-34

BREATHABLE FILMS FROM TPE WITH ETHER SOFT SEGMENT
Johnson L; Schultz D
Deerfield Urethane Inc.
(SPE,Thermoplastic Elastomers Special Interest Group; SPE,Philadelphia Section)

Breathable, or water vapour permeable films made from TPE, are finding increasing applications in the medical and garment industries. Their purpose is to protect the user against weather conditions like wind and cold rain, or biohazards like blood borne pathogens. Deerfield Urethane and its affiliate, Wolff Walsrode, have successfully developed a range of breathable TPE films based on ether type soft segment chemistry. The various grades of Pebatex, Walotex and Dureflex films have amide (PEBA), urethane (TPU) or ester (PEE) hard segments. The characteristic properties of ether-based TPE-like processability, elasticity, permeability and strength make this class of polymers perfectly suited for the application at hand: TPEs are extruded to form self-supporting films, which are designed for the lamination to textile fabrics. The TPE film serves as climate membrane by forming the barrier for wind, dust and droplets, while still allowing perspiration to escape, a process referred to as water vapour transmission. These laminates are among other applications being used for the manufacture of all weather apparel, shoes and personal protective equipment. The membrane application is described, together with the advantages and disadvantages of the various TPEs used. 16 refs.

WOLFF WALSRODE AG
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE
Accession no.771583

Item 232

MULTI-COMPONENT INJECTION MOULDING WITH TPEs
Tam E; Messina T
J-Yon Co.
(SPE,Thermoplastic Elastomers Special Interest Group; SPE,Philadelphia Section)

Thermoplastic elastomers have been used extensively in the consumer, electronics, power tools, horticultural, appliances, telecommunications, personal care products, and sports and leisure markets either as an insert moulding or as an overmoulding substrate in combination with rigid materials. The results are better soft-touch feel, ergonomics and a change of consumer taste preferences in soft versus hard feel. Several classes of thermoplastic elastomers that are designed as insert or overmoulding compound for high impact PS, K-resin, PP, ABS and polyamides such as nylon 6 and 6/6 without the use of adhesives are discussed. Mechanical properties of these materials are covered. Some typical applications and materials selection are illustrated.

USA
Accession no.771582

Item 233

PRACTICAL GUIDELINES FOR OVERMOULDING TPES: A MOULDER’S PERSPECTIVE
Schneider M
Rolco Inc.
(SPE,Thermoplastic Elastomers Special Interest Group; SPE,Philadelphia Section)

Overmoulding is a generic term that describes an injection moulding process or processes that produces a finished part with one resin (typically a thermoplastic elastomer) moulded over another (typically a rigid thermoplastic). Overmoulding can be accomplished with two major processes: insert moulding and two-shot moulding. Part design for overmoulding is critical and it is best to involve the manufacturer early in the development phase. 5 refs.

USA
Accession no.771581

Item 234

COMPOUNDING OF RUBBER CONCENTRATE THERMOPLASTIC VULCANISATES
Finerman T M; Vandendriessche L; Pfeiffer J E; Kirkendall K
Advanced Elastomer Systems LP
(SPE,Thermoplastic Elastomers Special Interest Group; SPE,Philadelphia Section)

Rubber concentrate thermoplastic vulcanisates (rubber concentrate TPVs) are dynamic vulcanisates which contain a high concentration of crosslinked rubber and a low concentration of plastic. Rubber concentrates are
intended to be further compounded with typical ingredients, such as oil, filler, PP, PE, stabilisers and process aids. As the rubber is already crosslinked, no curatives are needed in the compounding of the rubber concentrates. The specific selection of compound ingredients is dependent on the application requirements, raw material costs and process limitations. Emphasis is placed on rubber concentrate TPVs which are based on crosslinked EPDM rubber in a PP matrix. These rubber concentrate TPVs are designed for ease of compounding. The compounder thus has maximum flexibility in developing custom compounds for their thermoplastic elastomer applications. Key relationships between compound formulation and product performance are discussed. 11 refs.

USA

Accession no.771580

Item 235


USE OF PARAFFINIC PROCESSING OILS TO IMPROVE TPE PROPERTIES
Gedeon B J; Martin M; Yenni N L
ARDL; Chevron Products Co.
(SPE, Thermoplastic Elastomers Special Interest Group; SPE, Philadelphia Section)

Emphasis is placed on improved TPE physical properties obtained by the use of ‘clean’ paraffinic processing oils. These oils are manufactured using a new, all-hydroprocessing technology which lowers the aromatic content of the process oils. The result is a chemically pure, practically water-white process oil with exceptional colour stability and low volatility. These oils can be used in the compounding of TPEs to improve colour stability, oven ageing, fogging, compatibility, and other properties. 8 refs.

USA

Accession no.771579

Item 236


NEW UNIQUE THERMOPLASTIC VULCANISATE WITH ENHANCED PROPERTIES
Alha K
Optaplast Ltd.
(SPE, Thermoplastic Elastomers Special Interest Group; SPE, Philadelphia Section)

A new type of thermoplastic vulcanisate is available that combines the properties of PP or other polyolefins and polyacrylates. Material is produced by solid-state grafting and the final properties depend on applied compounding conditions and compatibilisation in addition to the used extenders, fillers and stabilisers. Polyolefin provides the continuous phase in composition and polyacrylate is finely dispersed. The solid-state grafting concept is a very flexible platform to tailor the basic properties of the elastomer. Technology can be stretched beyond acrylate to cover styrenic compositions as well. Due to a relatively simple manufacturing process these materials can be offered at moderate price levels to target selected combination of properties. Polyacrylate and PP compositions offer chlorine-free elastomer with good oil resistance, excellent weatherability and good adhesion to various paints and polyolefins with good surface smoothness. 8 refs.

EUROPEAN UNION; FINLAND; SCANDINAVIA; WESTERN EUROPE

Accession no.771577

Item 237


COMPARISON OF STYRENIC AND OLEFIN BASED TPES
Tam E; Lo L
J-Von Co.
(SPE, Thermoplastic Elastomers Special Interest Group; SPE, Philadelphia Section)

Several types of thermoplastic elastomers can be considered for use for many applications. These elastomers include SBS, SEBS, styrenic block TPE compounds, olefinic TPOs and TPVs. These materials are compared in terms of mechanical, elastic, thermal, surface and chemical resistance properties. Results of several case studies for material selection are also presented. 1 ref.

USA

Accession no.771576

Item 238

Philadelphia, Pa., 28th-29th Sept.1999, p.79-106

TPV AUTOMOTIVE WEATHERSEAL DESIGN: GLASS RUN CHANNEL CASE STUDY
Schrader S; Wilhelm V
Advanced Elastomer Systems LP; Manta Corp.
(SPE, Thermoplastic Elastomers Special Interest Group; SPE, Philadelphia Section)

The design of an automotive glass run channel weatherseal is investigated using finite element analysis (FEA) techniques. In particular, necessary design modifications are determined for converting the material from a thermoset rubber compound to a thermoplastic vulcanisate (TPV). The performance characteristics of the thermoset rubber design are analysed and used to establish a baseline for the TPV design. The TPV design is then modified using FEA techniques to achieve equivalent performance characteristics at a reduced system cost, as previously determined by the baseline thermoset design.

USA

Accession no.771574
REFERENCES AND ABSTRACTS

Item 239
CREATIVE PRODUCT DESIGN FOR THERMOPLASTIC ELASTOMERS
Banning R; Muhs J
Trimax LLC
(SPE, Thermoplastic Elastomers Special Interest Group; SPE, Philadelphia Section)
Design considerations for effective thermoplastic elastomer usage are presented.
USA
Accession no. 771572

Item 240
International Polymer Science and Technology
26, No.5, 1999, p.1-3
MAGNETIC THERMOPLASTIC ELASTOMER BLENDS FOR MEDICAL APPLICATIONS
Kisel L O; Krasovskii V N; Korolev D V; Suvorov K A
St. Petersburg, Technological Institute
Investigation into the properties of magnetic thermoplastic elastomer blends was carried out using various rubbers and included polyisobutylene. Barium ferrite was used as the magnetic filler. The materials produced showed such properties as to be of use in medical applications. 12 refs.
RUSSIA
Accession no. 771223

Item 241
HYTREL THERMOPLASTIC POLYESTER ELASTOMER : HYTREL HTR4275BK
DuPont de Nemours International SA
Hytrek HTR4275BK is a medium modulus, 160 MPa thermoplastic polyester elastomer grade with a nominal durometer hardness of 55D. Pigmented black with 0.5% fine particle size carbon black, the grade is designed for blow moulding or processing by other techniques requiring high melt viscosities. The datasheet tabulates the mechanical, thermal, and other properties of the grade together with processing data.
SWITZERLAND; WESTERN EUROPE
Accession no. 770884

Item 242
HYTREL THERMOPLASTIC POLYESTER ELASTOMER : HYTREL 4056
DuPont de Nemours International SA
Hytrek 4056 is a low modulus, 62 MPa thermoplastic polyester elastomer grade with a nominal durometer hardness of 40D. It contains a colour-stable antioxidant package and is suitable for extrusion applications. The datasheet tabulates the mechanical, thermal, electrical, flammable, and other properties of the grade and also provides processing data.
SWITZERLAND; WESTERN EUROPE
Accession no. 770883

Item 243
Journal of Applied Polymer Science
76, No.6, 9th May 2000, p.868-74
STRUCTURE-PROPERTY RELATIONSHIPS OF LIGHTLY CHEMICAL CROSSLINKED POLY(VINYL CHLORIDE) THERMOPLASTIC ELASTOMER
Yong-Zhong Bao; Zhi-Xue Weng; Zhi-Ming Huang; Zu-Ren Pan
Zhejiang, University
Chemically crosslinked PVC(C-PVC) was prepared by vinyl chloride(VC) suspension polymerisation in the presence of diallyl phthalate(DAP) and was plasticised to prepare PVC thermoplastic elastomer(TPE) materials. The chemical crosslinking and physical crosslinking structures in chemically crosslinked PVC-TPE were investigated. The gel fraction and crosslink density of gel were shown to increased as the feed concentration of DAP increased. C-PVC prepared by VC/DAP copolymerisation was lightly crosslinked as compared with irradiation crosslinked PVC. Physical entanglements would greatly influence the crosslink density of gel when the gel fraction was high. Chemical crosslinking had little effect on the recrystallisation behaviour of PVC. A structure model of chemically crosslinked PVC-TPE was proposed, in which chemical networks acted with physical networks cooperatively. 19 refs.
CHINA
Accession no. 770680

Item 244
Journal of Injection Molding Technology
4, No.1, March 2000, p.22-8
FUNDAMENTAL AND MATERIAL DEVELOPMENT FOR THERMOPLASTIC
ELASTOMER (TPE) OVERMOULDING
Weng D; Andries J; Morin P; Saunders K; Politis J
Teknor Apex Co.

The use of TPE compounds for overmoulding onto engineering thermoplastic resins is described. These compounds have a wide range of hardness and are bondable to a wide range of engineering thermoplastic and engineering thermoplastic elastomer substrates. The soft grades exhibit very smooth, tack-free, mar-resistant surfaces. The adhesion between the TPE and the substrate resists environmental changes such as hot air ageing and water immersion. The adhesion data and other physical data adhesion quantification methods, suggested processing conditions, and selected applications of these TPE overmoulding compounds are also presented. Theories in injection overmoulding are discussed. 7 refs.

USA
Accession no.769811

Item 246
Plastics Additives & Compounding
2, No.3, March 2000, p.9
NEW PEARLSCENT AND TRANSLUCENT COLOURS FOR TPE'S

This article highlights a new development from Vita Thermoplastic Polymers of the UK - a new range of thermoplastic elastomer compounds in pearlescent and translucent colours, which the company expects will create a whole new series of applications for TPE’s, with the automotive sector being one target market.

VITA THERMOPLASTIC POLYMERS;
SILVERGATE PLASTICS; VITA THERMOPLASTIC COMPOUNDS
EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE
Accession no.769568

Item 247
Polymers for the Medical Industry. Conference proceedings.
London, 29th-30th Nov.1999, paper 19
THERMOPLASTIC VULCANISATES: NEW MATERIALS OF CHOICE FOR HEALTH CARE
Severyns K
Advanced Elastomer Systems NV/SA
(Rapra Technology Ltd.)

For more than a century, the health care industry has had a growing need for materials offering the properties and functional performance of rubber. The principal elastomer used in health care applications is natural rubber, with butyl and silicone rubber being the next two most important ones. Moreover, the composition and chemistry of these health care materials has remained unchanged for many years. Some recipes are essentially the same ones as those developed fifty years ago. In addition to the properties - flexibility, elasticity, low set, etc. - normally expected of a rubber part, health care articles must have additional properties. They must have low toxicity and be suitable for service in direct contact with human skin, living tissue and fluids for injection into the bloodstream, with a minimal level of extractables into body fluids. Further, these articles must be suitable for sterilisation - steam autoclave, ionising radiation, ethylene oxide - with retention of rubber-like properties and no subsequent toxicity or loss of properties due to the sterilisation step. The use of EPDM/PP-based TPVs in the medical industry is described, highlighting the reasons why they are increasingly being specified for health care applications. 7 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION;
WESTERN EUROPE
Accession no.769486

Item 248
Modern Plastics International
30, No.2, Feb.2000, p.20
BLOW MOULDING TPVS
Richwine J R
Advanced Elastomer Systems LP

Soft thermoplastic vulcanisates are often blow moulded in conjunction with PP, for instance, to improve part performance and to eliminate multiple-piece assemblies. Current blow moulded applications with proven performance include under-the-hood systems such as rack and pinion boots and clean-air ducts. Some general guidelines are presented that can help produce the best quality blow moulded TPV parts.

USA
Accession no.766781

Item 249
Espoo, c.2000, pp.10. 30 cms. 13/3/00
PACREL THERMOPLASTIC ELASTOMER
Optatech Corp.

Pacrel thermoplastic elastomers are composed of a continuous polyolefin phase and a dispersed crosslinked polyacrylate phase. It is a thermoplastic vulcanisate, which has several valuable properties due to the chemical composition of the disperse phase. These properties are discussed, together with information regarding compounding and typical application opportunities.

EUROPEAN UNION; FINLAND; SCANDINAVIA; WESTERN EUROPE
Accession no.764776

Item 250
SPE Automotive TPO. Conference proceedings.
Troy, Mi., 20th-22nd Sept.1999, paper 37
PROCESS IMPROVEMENTS FOR TREATMENT OF TPOS FOR ENHANCED ADHESION OF PAINTS, SEALANTS AND ADHESIVES
Gutowski W S; Wu D Y; Li S

USA
CSIRO  
(SPE,Detroit Section)

A range of engineering and automotive TPO substrates is treated using a novel surface treatment process SICOR (Silane-on-CORona treated polymer) in order to enhance the adhesion with a range of structural adhesives, sealants, self-adhesive tapes and automotive paints. The process comprises two steps, i.e. surface oxidation implemented by corona discharge, flame treatment or chlorinated TPO primer. The adhesion and durability of automotive paints is comparable to that of currently used chlorinated primers, and significantly better than after flame treatment. The process is also shown to be as good as, or better than, plasma treatment. 12 refs.

AUSTRALIA  
Accession no.764219

Item 251  
SPE Automotive TPO. Conference proceedings. 
Troy, Mi., 20th-22nd Sept.1999, paper 34

SURFACE FINISHING/COMPRESSION (SFC) MOULDING - A NEW ROUTE TO FINISHING TPO  
Delusky A; Ellison T M; McCarthy S P; Guan Q  
ValTek LLC; Lowell,Massachusetts University  
(SPE,Detroit Section)

The Valyi SFC moulding process combines finishing and structural reinforcement in one moulding process. State-of-the-art Class A film finishes are bonded and formed in the compression moulding step. Further (post mould) priming, painting and solvent removal are eliminated. Finish adhesion to the moulding resin becomes an attribute for chip resistance rather than a continuing problem for primer and process development. In SFC moulding the film finish (paint film, PVC fabric or other) is placed over an open mould cavity in a vertical press. A traversing die is used to deposit resin onto the film. The melt bonds to the finish. Heat from the resin conditions the finish for forming. Long/continuous fibre-reinforcing material is then placed on the hot resin and the mould closed for the moulding cycle. The resulting part is taken from the mould - finished and uniquely reinforced. Mould clamping force and cavity pressure in the SFC process are greatly reduced compared to injection moulding. This opens the option for lower mass-lower cost tools and machines. Moulding (cavity) pressures for the Valyi Process are much lower compared to conventional injection moulding. The injection moulding issues of gates, knit lines and variable resin orientation are eliminated. Forming the heated finish by compression eliminates the preform step used in the insert back injection in-mould finishing process. The Valyi SFC moulding process is described, together with the advantages such as the mechanical performance of the part, reduction in cost and reduction in paint pollution, which can be achieved over the conventional injection moulding-painting process. 7 refs.

USA  
Accession no.764216

Item 252  
SPE Automotive TPO. Conference proceedings. 
Troy, Mi., 20th-22nd Sept.1999, paper 28

DESIGNING A TPO USING ETP MODIFICATION TECHNOLOGY  
Dean D M; Foltz J A; Sanford W M  
Du Pont de Nemours E.I.&, Co.Inc.  
(SPE,Detroit Section)

Thermoplastic (ETP) is a patented alloying technology utilising DuPont Surlyn Top Grain resins to modify flexible TPO systems. It is based on the reactive blending of a partially neutralised acid copolymer (ionomer), an epoxy functionalised ethylene copolymer and a standard TPO. The reaction between the epoxy groups of the ethylene copolymer and the free acid groups of the ionomer results in a partially crosslinked system which forms an in situ alloy with the TPO. This alloy imparts increased melt strength to the TPO, permitting significant increases in thermoforming performance and grain retention. By varying the amount and type of Surlyn ionomer within the alloy, a desired mix of mechanical properties, forming performance, and hand can be obtained. As the automotive industry moves toward developing interior components based on TPOs, this ability to customise a TPO-based material for specific applications provides a key advantage for the design engineer. For example, instrument panel skins can now be produced with reduced weight, reduced fogging and better resistance to heat and UV radiation relative to PVC/ABS, but yet possess the ability to undergo deep draws during thermoforming while maintaining grain definition. This unique combination of properties has led to the commercial adoption of Surlyn Top Grain for instrument panel skins on both the Opel Vectra and Saab 9000. Alternatively, formulations have been developed specifically for moulded-in-colour injection moulded soft touch surfaces, which require a different balance of melt behaviour and physical properties. The relationship between ionomer content and physical properties in ETP modified TPO systems is reported. The effect of incorporating an ionomer containing a softening acrylate comonomer on the ‘feel’ of the modified TPO material, as quantified by flexural modulus and durometer, is also discussed. 4 refs.

USA  
Accession no.764211
Item 253
SPE Automotive TPO. Conference proceedings.
Troy, Mi., 20th-22nd Sept.1999, paper 22
REACTOR TPO FOR PAINTED AND MOULD-IN-COLOUR THIN WALLED FASCIAS
Luce J T
Exxon Chemical Co.
(SPE,Detroit Section)
Automotive bumper fascia designs are moving toward thin wall designs to reduce cost and weight for both painted and moulded-in-colour (MIC) applications. The olefin family of resins has played a major role in allowing bumper manufacturers to achieve their cost reduction objectives. Reactor thermal plastic olefins (RTPOs) will continue to play an increasing role by offering improved ‘value-added’ products to meet these new thin wall design trends of the future. Exxon Chemical’s approach to offering ‘value-added’ high stiffness RTPOs modified with metallocene elastomer technology is described, and the performance criteria necessary for achieving robustness for painted and MIC fascias are evaluated. 5 refs.
USA
Accession no.764197

Item 254
SPE Automotive TPO. Conference proceedings.
Troy, Mi., 20th-22nd Sept.1999, paper 14
ADHESION, DURABILITY AND DUCTILITY: THE PAINTED TPO PART PERFORMANCE ENVELOPE
Frazier D
Montell USA Inc.
(SPE,Detroit Section)
Thermoplastic polyolefin (TPO) suppliers are continuing to push the adhesion/durability/ductility performance envelope to provide materials that perform better in the field. The ‘old technology’ resins of ten years ago are a far cry from the high-performance, high-durability reactor materials found on many vehicles today. Every year, new methods are developed for determining the durability of painted TPO materials. With the testing technology that is available today, more and more data become available as new types of impact, scuff and gouge tests are developed. However, nothing is more important in providing a robust ‘system’ than the inherent cohesive strength of the TPO substrate itself. Painted part performance relies on much more than just one category of investigation. Sometimes it is easy to forget this, especially if field failures of one type force focusing on just one part of the triangle. Resin manufacturers prefer to think in terms of a balance of properties that make up this envelope, rather than focusing on one aspect such as adhesion or durability. This part performance envelope is discussed in a new light. The relative advantages and disadvantages of the old and new durability test methods. It is shown which variables dictate the level of performance within each type of test, and the lab-generated performance of different TPO materials is related to an expectation of overall field performance.
USA
Accession no.764205

Item 255
SPE Automotive TPO. Conference proceedings.
Troy, Mi., 20th-22nd Sept.1999, paper 12
THERMOFORMING BEHAVIOUR OF OLEFINIC INSTRUMENT SKINS
Yu T C
Exxon Chemical Co.
(SPE,Detroit Section)
Currently thermoplastic olefins (TPO) are being used for injection moulded or extruded automotive exterior parts. Due to lack of melt strength of the PP base resin, thermoformable TPO is still under development for automotive interior skins. The advantages of TPO skins over the current PVC/ABS skins are long-term ageing, reduced fogging and improved recycling. Laboratory evaluation for formability usually involves uncommon and tedious tasks. Dynamic mechanical analysis is used in tension mode to predict the optimum temperature range for thermoforming, extent of network enhancement, as well as other mechanical properties. 11 refs.
USA
Accession no.764195

Item 256
SPE Automotive TPO. Conference proceedings.
Troy, Mi., 20th-22nd Sept.1999, paper 7
“ESPOLEX™” : NOVEL TPO POWDER FOR POWDER SLUSH MOULDING AUTOMOBILE INTERIOR SKINS
Imai A; Nakatsuji I; Shimizu H; Sugimoto H
Sumitomo Chemical Co.Ltd.
(SPE,Detroit Section)
A skin layer of vehicle interior parts such as instrument panel (dashboard) or door panel of most deluxe cars has been manufactured by powder slush moulding (PSM) PVC powder. Sumitomo Chemical has developed a TPO powder for PSM, which substitute the current PVC powder from various environmental points of view. Concurrently developed polyolefinic ingredients, powder technologies and evaluation methods have led to the completion of the development. The novel TPO powder (Espolex) has excellent powder flowability and melt property, thus a skin obtained by PSM has good appearance and no pinholes or wormholes are found on its surface. The moulded skin shows good physical properties, such as soft touch-feeling, durability, scratch resistance and cold resistance. 3 refs.
JAPAN
Accession no.764191
STUDIES IN POLYMER-POLYMER ADHESION:
ADHESION OF ETHYLENE-OCTENE
COPOLYMERS TO POLYPROPYLENE
Godail L; Mackinlay A C; Packham D E
Bath,University
(IOM Communications Ltd.)

A study was made of the adhesion to PP of four ethylene-octene copolymer thermoplastic elastomers differing in density and melt flow index. Successful melt bonding was achieved by compression moulding a PP sheet at 250°C and subsequently moulding the copolymers onto its surface at a range of temperatures. Adhesion between the laminated polymers was measured by a 90 degree peel test. All the copolymers showed peel energy maxima at about 160°C, the melting region of the PP, with the magnitude of peel energy maximum depending on the particular copolymer. It is argued that this maximum energy could be related to differences in bulk energy dissipation properties of the copolymers. 19 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.759636

DYNAMICALLY VULCANISED THERMOPLASTIC ELASTOMER BLENDS OF POLYETHYLENE AND NITRILE RUBBER
George J; Varughese K T; Thomas S
Mahatma Gandhi University

The rheological, mechanical, dynamic mechanical, and morphological properties of dynamically crosslinked blends of high density polyethylene and acrylonitrile butadiene rubber were studied in relation to the dosage of the crosslinking agent, dicumyl peroxide (DCP). The crosslink density increased with increasing DCP content. The blends were immiscible, forming two-phase structures. It was concluded that dynamic crosslinking resulted in a finer and more stable morphology, with improved mechanical properties, compared with conventional blends. The dynamically crosslinked material could be processed like thermoplastics. 12 refs.

INDIA
Accession no.760712

BETTER BLADDERS WITH TPUS
Collette D
Stevens Urethane

Characteristics and properties are discussed for thermoplastic polyurethanes for use in demanding applications where environmental factors and tough physical abuse need to be taken into account. The chemical and molecular structure of urethanes is described, and general properties are indicated for Stevens’ aromatic TPU film, and comparisons are made with other flexible materials such as natural rubber, synthetic rubber, PVC, metallocene PEs, ether-based TPUs, ester-based TPUs and aliphatic TPUs

USA

ETP-TPO TECHNOLOGY FOR INSTRUMENT PANEL SKINS
Dawson R L; Sanford W M
Du Pont de Nemours E.I.,& Co.Inc.
(SPE,Automotive Div.)

Thermoplastic polyolefin (TPO) skins offer several desirable property advantages over PVC/ABS skins presently used for most automotive instrument panels (IP) such as reduced weight, reduced fogging, better resistance to heat and UV and case of recycling. As the automotive industry strives to improve the performance and longevity of instrument panels, increasing emphasis is being placed on TPO as a material candidate. These materials, however, have limitations in grain retention, thermoforming, and hand. DuPont has developed a technology known as ETP-TPO (elastomeric thermoplastic thermoplastic polyolefin) which modifies TPUs so that they have excellent thermoforming even with deep draws, excellent grain retention, and an improved hand or soft touch. ETP technology is based on forming an in situ alloy of Surlyn C ionomer and an epoxy functionalised ethylene copolymer, Elvaloy, and can be applied to modify virtually...
all types of TPO, including reactor grades. This dynamically crosslinked alloy imparts increased melt strength to the TPO which permits significant increases in thermoforming performance and grain retention. By varying the amounts and grades of Surlyn C used, as well as the other components of the TPO, the compounding can tailor the material to obtain a desired mix of mechanical properties, forming performance and hand. Instrument panel skins based on extruded ETP-TPO sheet are commercial on the Opel Vectra in Europe and Brazil, and the Saab 9000, and a door panel application in Europe to be commercialised in 1998. Recent advances have also led to the development of lower cost ETP-modified TPOs and ETP modification of calendered TPOs.

USA
Accession no.758943

Item 262
Plastiques Modernes et Elastomeres
51, No.8, Nov.1999, p.9-14
French
SEBS AND PARTIALLY VULCANISED THERMOPLASTIC ELASTOMERS TAKE A LEAD
Renaudat E
The properties and applications of thermoplastic elastomers based on styrene-ethylene butylene-styrene block copolymers and dynamically vulcanisable PP/rubber alloys are examined. Materials developments by a number of companies are reviewed.

GUMMIWERK KRAIBURG; COUSIN-TESSIER ET CIE; MULTIBASE SA; HANNA M.A.,CO.; VITA THERMOPLASTIC POLYMERS; ADVANCED ELASTOMER SYSTEMS; ALPHAGARY; DSM NV EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; NETHERLANDS; UK; USA; WESTERN EUROPE
Accession no.758788

Item 263
156th ACS Rubber Division Meeting - Fall 1999. Conference preprints.
Orlando, Fl., 21st-23rd Sept.1999, paper 51
NOVEL THERMOPLASTIC VULCANISATES WHICH EXHIBIT EXCELLENT ADHESION TO TEXTILE FIBRES DURING MELT PROCESSING
Hill M C
Advanced Elastomer Systems LP (ACS,Rubber Div.)
Engineered thermoset and thermoplastic elastomers are used in combination with reinforcing materials such as textile cords and fabrics for engineered composite applications such as hose and belting. The level of adhesion between the elastomer and the reinforcement must exhibit peel strengths of greater than 42 N/2cm to ensure the ultimate strength and overall performance of the finished composite structure. Typical elastomers require the use of an adhesive system or yarn treatment to facilitate adhesion to the reinforcing substrate. The treated yarns are chemically adhered to the thermoset rubber materials during vulcanisation, whereas adhesion of thermoplastics to textile reinforcement takes place through the use of adhesives after melt processing. These adhesives generally require 72 hours to achieve a full cure. Both adhesion techniques increase the stiffness and weight of the final composite construction. The development of novel TPVs exhibiting excellent adhesion to polyamide and polyester reinforcing materials during melt processing is described. These unique TPV formulations show peel strengths greater than 50 N/2cm to both polyester and polyamide fibres during extrusion. This level of adhesion to textiles combined with the lightweight and flexible characteristics of TPVs contribute to improved performance for engineered composite structures. 7 refs.

USA
Accession no.758345

Item 264
156th ACS Rubber Division Meeting - Fall 1999. Conference preprints.
Orlando, Fl., 21st-23rd Sept.1999, paper 13
IONIC THERMOPLASTIC ELASTOMERS
Antony P; De S K
Indian Institute of Technology (ACS,Rubber Div.)
A review is presented of recent studies on the development of ionic thermoplastic elastomers based on ionomeric polyblends. The ionomeric polyblends studied include zinc salt of maleated EPDM rubber and zinc salt of maleated HDPE, zinc salt of maleated EPDM and zinc salt ethylene-acrylic acid copolymer, zinc salt of maleated EMM rubber and zinc salt of maleated PP, zinc salt of carboxylated nitrile rubber and zinc salt of maleated HDPE, zinc salt of carboxylated nitrile rubber and zinc salt of ethylene-methacrylic acid copolymer, zinc salt of carboxylated nitrile rubber and zinc salt of propylene-acrylic acid copolymer, zinc salt of carboxylated nitrile rubber and zinc salt of ethylene-acrylic acid copolymer, and aluminium salt of chlorosulphonated PE and aluminium salt of maleated EMM rubber. In this case the compatibilisation between the rubbery and the plastic phases is achieved by using intermolecular ionic interactions, as indicated by the synergism in physical properties. In the absence of ionic groups, the corresponding blends are incompatible, as shown by the poor physical properties. The ionomeric polyblends can be reprocessed like thermoplastics and in physical properties they behave like vulcanised rubbers. 60 refs.

INDIA
Accession no.758312

Item 265
Anaheim, Ca., 27th Jan.1999, paper 3

DESIGN PROPERTIES OF HIGH PERFORMANCE THERMOPLASTIC ELASTOMER COMPOUNDS
Acquarulo L A; O’Neil C J
Foster Corp.
(Canon Communications LLC)

Advances in design and function of medical devices have led to an increased need for consistent, close-tolerance, high-performance thermoplastic elastomer compounds. An overview of thermoplastic elastomers is presented. Advantages and disadvantages of the different families of thermoplastic elastomers are listed, with emphasis on the two families of thermoplastic elastomers that are currently being used successfully in the manufacture of a number of medical devices. Ways in which these two families may be modified to produce even more high performance characteristics that could be of great benefit to the device manufacturer are introduced. 3 refs.
USA
Accession no.755205

Item 266
Rubber and Plastics News
29, No.8, 15th Nov.1999, p.10
ECI PINS HOPES ON NON-CHLORINATED TPE GLOVE
McNulty M

ECI Medical Technologies is introducing a non-chlorinated, powder-free thermoplastic surgical glove. The product uses pre-dip and post-dip processes to eliminate the need for powder during manufacture. The post-dip acts as a damp-hand donning lubricant, while the outside layer prevents the gloves from sticking to one another and makes it easier to grip instruments. The base glove is made of the company’s Elastylon thermoplastic elastomer.
ECI MEDICAL TECHNOLOGIES INC. CANADA
Accession no.756664

Item 267
Plastics in Building Construction
23, No.11, 1999, p.5-8
EXPANSION JOINTS MADE OF THERMOPLASTIC RUBBER PROVIDE SOLUTIONS FOR TWO PROJECTS

This detailed article looks at the use of Santoprene thermoplastic rubber from Advanced Elastomer Systems in two expansion joint applications. The first is reported to be a highly innovative expansion joint made from Santoprene 8000 for allowing seismic movement between the corridors and an adjacent elevator tower at the 10-floor Hoag Presbyterian Memorial Hospital in Newport Beach, California. C/S Group Inc. is reported to have developed the expansion joint and it was said to have been extruded by Fabricated Extrusions Inc. The second project is said to involve the development of Thermaflex leak-proof expansion joints for parking decks. The University of Akron in Ohio is reported to have retrofitted the top level of a main parking structure with Santoprene rubber expansion joints extruded by Emseal Joint Systems Ltd.

ADVANCED ELASTOMER SYSTEMS; C/S GROUP INC.; FABRICATED EXTRUSIONS INC.; AKRON,UNIVERSITY; EMSEAL JOINT SYSTEMS LTD.
USA
Accession no.752798

Item 268
Revista de Plásticos Modernos
78, No.517, July 1999, p.12

Spanish
PERMANENT MARKING OF THERMOPLASTIC ELASTOMER PROFILES

The introduction by Bergmann Kunststoffwerk of the Bergaflex FastMARK range of thermoplastic elastomers is reported. These materials, which have also been introduced in Spain by Polibasa, are of particular interest for profile extrusion applications. The profiles can be permanently marked and colour coded by laser beam during the extrusion process.

POLIBASA; POLIAMIDAS BARBASTRO SA; HANNA ENGINEERED MATERIALS EUROPE; BERGMANN T.,KUNSTSTOFFWERK EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; SPAIN; UK; WESTERN EUROPE

Accession no.752762

Item 271
Rubber World
220, No.6, Sept.1999, p.35-42
TPVS IN ELASTOMERIC FIBRE APPLICATIONS
Willems E; Gelissen F; Versluis C; Bastiaansen K
DSM Research NV; Eindhoven,University of Technology

Thermoplastic vulcanisates are a class of thermoplastic elastomers which typically consist of a finely dispersed chemically crosslinked elastomer phase in a melt-processable thermoplastic matrix. In this particular study, a new class of TPV materials is presented, and their processing behaviour and properties are discussed with a special emphasis on fibre applications. The TPV material was produced by combining a copolyetherester and a chemically crosslinked EPDM rubber in a dynamic vulcanisation process. The resulting melt-spun fibres have improved elastic properties compared to 100% copolyetheresters and traditional TPV materials. The copolyetherester-EPDM TPV fibres may well be heat resistant and dyeable in polyester dyeing processes. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.749890

Item 273
Chicago, Il., 13th-16th April 1999, Paper 77, pp.45
CUT GROWTH OF SBS THERMOPLASTIC ELASTOMERS
Hirst D G; Farid A S; Fuller K N G
North London,University; Tun Abdul Razak Research Centre MR PRA (ACS,Rubber Div.)

Cut growth and tearing energy were examined in styrene-butadiene-styrene block copolymer thermoplastic elastomers. The contribution of the styrene phase to cut growth was investigated using single edge cut specimens in a dynamic uniaxial mode of deformation and trouser tear sample geometry. It was found that the direction of molecular orientation arising from processing had a profound effect on crack growth, and crack blunting was identified as the main mechanism by which resistance to dynamic cut growth was enhanced. 29 refs.

MALAYSIAN RUBBER PRODUCERS’ RESEARCH ASSN.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA; WESTERN EUROPE

Accession no.749889
Item 275
New York City, 2nd-6th May 1999, p.1744-8. 012
BARRIER PROPERTIES OF THERMOPLASTIC POLYURETHANE FILM FOR BLADDERS AND OTHER CONTAINMENT APPLICATIONS
Schultz D
Deerfield Urethane Inc. (SPE)
Gas transport properties of various thermoplastic PU (TPU) films are presented as a function of gauge, temperature and humidity. Influence of the TPU’s chemical constitution on the transport characteristics is discussed. Empirical data for the different gases and comparison to other soft elastic polymers permit rules of thumb for the selection of appropriate TPU grades for various applications. 18 refs.
USA
Accession no.748710

Item 276
Canadian Plastics
57, No.6, June 1999, p.25-6
SOFT SELLS
Anderton J
Thermoplastic elastomers (TPEs) are seeing increased usage. From toothbrush handles to automotive gaskets, applications in TPEs are soaring. There are many technical reasons for this trend, but as the Estane Thermoplastic Polyurethane Division of B.F.Goodrich Performance Materials comments: TPEs offer design flexibility versus rubber. They offer the performance of rubber type products with recyclability, and a lot more design options such as soft touch applications, and harder applications which retain good flexibility at both low and high temperatures. They bridge the gap between rubber and ‘hard’ plastics. A review of TPE grades from a number of companies is presented.
GOODRICH B.F.,CO.; NEOPTX INC.; TEKNOR APEX CO.; BASF CANADA INC.; ELF ATOCHEM SA; ADVANCED ELASTOMER SYSTEMS LP; BAYER CORP.
CANADA; USA
Accession no.748756

Item 277
Koln, 1999, pp.36. 30cms. 3/9/99
ACLATHAN-ACLACELL PUR PLASTIC MATERIALS FOR ENGINEERING. ELASTIC MATERIALS FOR HIGHLY DYNAMIC APPLICATIONS
Acla-Werke GmbH
Information is presented on Aclathan and Aclacell, engineering polyurethane elastomer materials based on Vulkollan raw materials from Bayer. Aclathan mouldings are suitable for industrial applications requiring exceptionally high wear resistance combined with a high mechanical loadbearing capacity. Other characteristics include high rebound resilience, tear propagation resistance, low compression set and high thermal stability. Aclacell, a polyurethane expanded with water, has a high dynamic load-bearing capacity and can withstand a high degree of compression with minimal permanent set. The brochure summarises the key features of each grade and presents key properties data. Details are given of processes for the production of Aclathan and Aclacell, while examples of their use in such applications as springs, abrasion-proof coatings, seals and machine components are also outlined.
BAYER AG
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.747082

Item 278
New York City, 2nd-6th May 1999, p.1689-93. 012
NEW POLYOLEFIN-BASED THERMOPLASTIC VULCANISATES
Fritz H G
Stuttgart,University (SPE)
Details are given of the formulation and generation of novel thermoplastic vulcanisates based on PP/PEO and PU/PVAC compositions. Thermomechanical and physical properties are discussed. 4 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.744521

Item 279
Macplas
24, No.207, April 1999, p.109-10
Italian
DRAINING ASPHALTS
The use of rubber-modified asphalts for road surfaces having improved water drainage properties is discussed. Particular attention is paid to Eliflex modified bitumen developed by Agip Petroli using EniChem’s Europrene Sol T styrene-butadiene-styrene block copolymer thermoplastic elastomer.
ENI GROUP; AGIP PETROLI SPA; ENICHEM SPA
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.742593

Item 280
Polymer Degradation and Stability
ANALYSIS OF WEATHERING OF A THERMOPLASTIC POLYESTER ELASTOMER. II. FACTORS AFFECTING WEATHERING OF A
POLYETHER-POLYESTER ELASTOMER
Nagai Y; Ogawa T; Nishimoto Y; Ohishi F
Kanagawa, University

The photodegradation, thermal degradation and hydrolysis of the above thermoplastic elastomer were investigated. The effects of wavelength range of light on photodegradation, the effect of water on photodegradation during irradiation and the effect of temperature during photoirradiation were examined and the results compared with those of outdoor and accelerated weathering tests. 8 refs.

JAPAN
Accession no.742189

Item 281
Journal of Reinforced Plastics & Composites
18, No.6, 1999, p.518-28
EFFECT OF SEVERAL KINDS OF OILS ON THE OIL RESISTANCE BEHAVIOUR OF POLYSTYRENE THERMOPLASTIC VULCANISATE
Tasaka M; Tamura A; Mori R
Riken Vinyl Industry Co. Ltd.

The oil resistance of PP/polystyrene block copolymer (Septon 4077) thermoplastic elastomers was investigated using dynamic mechanical spectrometry and TEM. Samples were immersed in various oils (paraffin oil, ASTM oil, an automobile grease and petrol) and their mechanical properties determined after oil immersion. The relationship between phase structure and mechanical properties is discussed with regard to thermal analysis, DMA and morphology. 17 refs. (56th Annual Technical Conference, SPE, Atlanta, GA, 26-30 April, 1998)

JAPAN
Accession no.741315

Item 282
Plastics Engineering
55, No.6, June 1999, p.66
RUBBER BONDS TO RIGID SUBSTRATES
New grades of Alcryn melt-processable rubber provide virtually universal bondability to rigid engineering substrates in overmoulding and coextrusion applications, it is claimed. Used in hard/soft composite components, the commercial grades of Alcryn MPR reportedly form melt or chemical bonds to rigid substrates, such as PVC and polycarbonate/ABS blends.

ADVANCED POLYMER ALLOYS
USA
Accession no.739239

Item 283
British Plastics and Rubber
May 1999, p.27
LASER MARKING OVERCOMES TPE PRINTING PROBLEMS
Thermoplastic elastomers based on SEBS do not provide a particularly good surface to achieve
M A Hanna has produced its Bergaflex FastMark series formulated for laser marking. Additives sensitive to laser light are compounded in and achieve their effects through a number of mechanisms. A thermal reaction may occur leading to carbonisation, thereby leaving a black mark. Foaming on the surface will leave a white mark. It is also possible that the pigment colour itself may change.

**HANNA M.A.,CO.**
USA

*Accession no.734215*

**Item 286**

**Antec ’99. Volume III. Conference proceedings.**
New York City, 2nd-6th May 1999, p.3479-83. 012

**OVERMOULDING AND COEXTRUDING MELT PROCESSABLE RUBBER ON RIGID SUBSTRATES**
Zwick P
Advanced Polymer Alloys (SPE)

The use of melt processable rubber (MPR) in overmoulding and coextrusion with various rigid plastic substrates is reviewed. Looking to improve product quality and develop new applications, plastics engineers are turning to MPR technology to cost-effectively add the high performance properties and soft texture of rubber to their products. MPR exhibits superior resistance to weather, oils, chemicals, gasoline and UV light, and is processed on plastics equipment, which provides potential savings.

**USA**

*Accession no.733750*

**Item 287**

**Modern Plastics International**
29, No.5, May 1999, p.56/63

**HIGH-CLARITY TPE’S OFFER NEW PACKAGING OPTIONS**
Mapleston P

This article examines the development of clear thermoplastic elastomers and plastomers (based on olefin and styrene monomers) which are now being introduced world-wide, and which are rapidly changing the landscape of the packaging world. The latest developments from key manufacturers are highlighted in detail.

DOW; BASF; SHELL CHEMICALS; SHIN-ETSU; FINA CHEMICALS; PHILLIPS PETROLEUM; EASTMAN CHEMICAL CO.; DEX-PLASTOMERS; UNION CARBIDE; EXXON; HANNA ENGINEERED MATERIALS EUROPE AFRICA; EUROPE-GENERAL; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; MIDDLE EAST; UK; USA; WESTERN EUROPE

*Accession no.733546*

**Item 288**


**DESMOPAN THERMOPLASTIC POLYURETHANE ELASTOMER**
Bayer AG

Desmonpan is a thermoplastic polyurethane elastomer which combines the properties of high-quality PUR elastomers with the processibility of thermoplastics. Advantages include high abrasion resistance, flexibility over a wide temperature range, good elasticity, and good resistance to weathering as well as to oils, greases and many solvents. The product literature presents information on Desmonpan’s mechanical, physical, thermal and chemical properties and describes the special features of each of the eleven grades. Processing characteristics are outlined and examples given of the use of Desmonpan in such applications as automotive, mechanical engineering, cables and wiring, hoses, film, and sport and leisure.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

*Accession no.733455*

**Item 289**

*Journal of Vinyl and Additive Technology*
5, No.1, Mar.1999, p.52-7

**PVC-BASED TPEs FOR YEAR 2000 AND BEYOND**
Weng D; Morin P; Saunders K; Andries J
Teknor Apex Co.

Soft, low compression set and chemically resistant thermoplastic elastomers (TPEs) are developed from advanced PVC blend technology. These blends have low-temperature flexibility comparable to that of commonly used TPEs and can be made flame retardant. These new TPEs are suitable for applications in consumer products, automotive, wire and cable insulation, and jacketing. This new class of TPEs, suitable for injection and extrusion operations, represents a significant advance in PVC compounding technology. 4 refs.

**USA**

*Accession no.732319*

**Item 290**

*Italian Technology*
No.2, May 1999, p.128

**ENHANCED OVERMOULDING POSSIBILITIES WITH TPE**

Thermoplastic elastomers have always been among the specialities of API, and these are materials whose applications are continuously expanding due to the efforts of producers and to the interesting cost/performance ratio TPE provide. In the wide range of thermoplastic elastomers from API, the SEBS-based Megol products are the most representative. This family includes a complete series of compounds based on SEBS ‘conventional’ technology, compatible with polyolefins.
Because of their good thermal and chemical compatibility, soft Megol SEBS compounds can be overmoulded with an excellent adhesion to PP, PE and EVA products. Details are given.

API
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.732274

Item 291
Boston, Ma., March 1999, p.623-4. 012
SYNTHESIS, CHARACTERISATION AND PROPERTIES OF CO-POLYETHERESTERS BASED ON POLYETHYLENE NAPHTHALATE-CO-ETHYLENE-4,4'-BIPHENYLDICARBOXYLATE AND POLYTETRAMETHYLENE OXIDE
Schroder C; Vulic I; Buning G W
DSM Research BV
(ACS,Div.of Polymer Chemistry)
The use of thermoplastic copolyester elastomers (COPE) based on PBTP and polytetramethylene oxide (PTMO) or PPO-ethylene oxide copolymers has increased, combining the positive aspects as creep, compression set and fatigue behaviour of rubbers with the processability of thermoplastic polyesters. Initially these thermostatic elastomers were based on PETP. A major disadvantage of these PETP-based COPE systems is the very slow crystallisation behaviour. An interesting aspect of PETP-based COPE is increased heat resistance. With the commercialisation of 2,6-naphthalene dicarboxylic acid dimethylester (NDC) a further increase in heat resistance could be possible; however, the copolymers based on NDC, 1,2-ethylene glycol and PTMO crystallise even more poorly. A solution for the slow crystallisation of PETP has been found via the use of 1,4-butane diol as glycol, creating PBTP and PBN based COPEs. Crystallisation can also be enhanced by building in more rigid comonomers, e.g. 4,4'-bienzoic acid dimethylester (BB). The results of a study on the polymerisation and crystallisation behaviour for COPEs containing 2,6-naphthalene dicarboxylic acid, 4,4'-bienzoic acid, ethylene glycol, using polytetramethylene oxide 1000 as soft segment are reported. 4 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.729084

Item 293
TPE '98. Conference proceedings.
PRACTICAL APPLICATIONS IN TOOLING, INJECTION MOULDING TECHNIQUES
Pokorny P
Engel Austria Ltd.
(Rapra Technology Ltd.; Plastics & Rubber Weekly)
There is a wide range of possible applications for thermoplastic elastomers in multi-component parts. This particular market is forecast to rapidly increase over the next few years. It is important that designers, mouldmakers, and mould and machine suppliers work together. Aspects covered include bonding of TPEs to other thermoplastics, material combinations, mould technologies in multi-component injection moulding and design of multi-component injection moulding machines.
AUSTRIA; WESTERN EUROPE
Accession no.729083

Item 294
TPE '98. Conference proceedings.
THE PROPERTY MAGNET
Reeves N
Elf Atochem UK Ltd.
(Rapra Technology Ltd.; Plastics & Rubber Weekly)
Polyether block amide copolymers can not only be used as a material in its own right, but also as an additive or modifier in other polymers. This results in some very diverse applications and a large range of properties exploited. The elastomeric properties of this TPE come from the polyether
segments that are combined with polyamide sections to form the backbone. The various applications place different requirements on the material. Many applications make use of the flexible nature of this polyamide copolymer, especially those not permitting the use of plasticisers. In addition, many applications demand a material which can operate over a very wide temperature window, typically -40deg.C up to 70 deg.C, with little or no change in physical properties. Pebax is routinely used to improve the physical properties of nylon 6 film, TPU processing and to provide antistatic properties in other polymers.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.729081

Item 295
TPE '98. Conference proceedings.

INNOVATIVE TPE SOLUTIONS IN AUTOMOTIVE WEATHERSEAL APPLICATIONS
Glokler J
Advanced Elastomer Systems NV/SA
(Rapra Technology Ltd.; Plastics & Rubber Weekly)

Engineered TPE, especially products like Santoprene thermoplastic rubber, are already demonstrating their performance capability in automotive weatherseal applications. These materials are able to overcome recognised thermoset rubber limitations. An excellent cost/performance balance, a potential weight reduction, colouring options and coextrusion with rigid thermoplastic materials are the key advantages versus classical EPDM thermoset rubber profile system. Excellent track records in solid static and dynamic sealing applications are giving the confidence for further penetration. The ability to foam TPEs with water as blowing agent is a breakthrough and now thermoset sponge applications can also be replaced with an environmental friendly TPE process. Commercialisation of the coextruded solid foot (gripper) and the water foamed bulb seals as door and trunk seals are underway. The automotive industry has recognised the potential of engineered thermoplastic elastomers and is pushing the supply chain to offer TPE based weatherseal systems. Advanced Elastomer Systems (AES) is able to support dedicated resources the product and application development of Santoprene thermoplastic rubber in solid and foamed automotive weatherseal applications. 7 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE
Accession no.729081

Item 296
TPE '98. Conference proceedings.

TPE PROFILES IN THE EUROPEAN CAR INDUSTRY

Samel R
EuroTrends Research Ltd.
(Rapra Technology Ltd.; Plastics & Rubber Weekly)

A summary is presented of EuroTrends’ recent market survey, entitled Rubber Profiles in the Western European Car Industry, 1996-2001. The market was analysed by type of elastomer and location of seal on the car body. Thermoset rubber compounds are traditionally the materials of choice for extruded profiles, for scaling doors, windows, boot lids and other areas of passenger cars. EPDM has generally replaced SBR in these applications. There is now a wide range of thermoplastic elastomers which compete in the market place. Although comparatively new materials, TPEs have become significant in tonnage and value terms because of their attraction to plastic processors as a means of expanding into this market sector, previously the domain of the rubber industry. Traditionally the rubber industry has regarded TPEs as somewhat inferior products unable to meet the high performance of resilient thermoset elastomers, but it is now recognised that there are a number of applications which can accept compromises in performance. TPEs’ greatest problem is their inability to retain elastomeric properties at extremes of heat and cold limiting their application to profiles which are located in static locations such as window seals. In general, the car industry still regards TPEs as unsuitable for door, boot and bonnet seals as they do not return to their original shape after long periods of compression. However, progress has been made in designing profiles that will function satisfactorily in the automotive environment.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.729080

Item 297
TPE '98. Conference proceedings.

AN OIL RESISTANT, HEAT RESISTANT TPV
Patel J; Tinker A J
Tun Abdul Razak Research Centre
(Rapra Technology Ltd.; Plastics & Rubber Weekly)

A thermoplastic vulcanisate (TPV) is developed from dynamically vulcanised blends of PP and epoxidised NR (ENR), a commercially available modified form of NR. Both the processing behaviour and physical properties are typical of a TPV, although compression set at high temperatures is particularly impressive. The latter derives in part from the excellent heat resistance of this material, both in respect of very long term ageing - for instance one year at 100 deg.C - and short term accelerated ageing such as three days at 150 deg.C. Oil resistance is also very good, being comparable with that attained from well-compounded medium acrylonitrile NBR in respect of both volume swelling and retention of properties after ageing in hot oil. PP provides resistance to ozone cracking, in common with other TPVs. The excellent heat stability is...
also reflected in excellent retention of properties on recycling - an important requirement for a successful TPE. 16 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.729078

Item 298
A TPE-E MATERIAL WITH VERSATILE PROPERTIES AND APPLICATION POSSIBILITIES
Creemers H
DSM Engineering Plastics
(Rapra Technology Ltd.; Plastics & Rubber Weekly)

There is a large number of applications using materials that appear to be made from traditional rubber, but are in fact made from thermoplastic elastomers. There is an entire family of thermoplastic materials available in the current market with their own specific property features, ranging from styrene block copolymers, thermoplastic olefins and vulcanisates, to thermoplastic PUs, copolyesters and copolyamides. Emphasis is placed on thermoplastic elastomers based on polyesters (TPE-Es or COPEs). Polyester-based thermoplastic elastomers are high performance elastomers offering thermoplastic processability and an unusual combination of physical and chemical properties. COPEs can be used in a very broad spectrum of applications based on their good mechanical strength at high and low temperatures, but also on their high abrasion, tear, fatigue and solvent resistance. DSM is offering to the marketplace so-called polyetheresters and polyesteresters. Details are given.
EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.729077

Item 299
THE PROPERTIES AND APPLICATIONS OF A NEW STYRENE THERMOPLASTIC ELASTOMER
Wunsch J R; Beumelburg C; Jauer G; Knoll K; Weinkoetz P
BASF AG
(Rapra Technology Ltd.; Plastics & Rubber Weekly)

Styrolux and Styroflex are both styrene and butadiene based block copolymers prepared by butyllithium initiated anionic polymerisation. Styrolux is a transparent, tough and stiff thermoplastic material for high speed processing. Its specially designed molecular structure allows homogeneous mixing with general purpose PS, maintaining the transparency. Styroflex is an experimental product with the mechanical behaviour of a thermoplastic elastomer, e.g. low modulus and yield strength, high elongation and excellent recovery. High transparency and thermal stability give the competitive edge over conventional styrene-butadiene elastomers. Styroflex, Styrolux and general-purpose PS form a unit construction system, e.g. for transparent film materials and injection moulded parts with fine-tunable hardness and toughness. 11 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.729076

Item 300
NEW APPLICATIONS USING THE UNIQUE PROPERTIES OF THERMOPLASTIC POLYESTER ELASTOMERS
Deane P W
DuPont (UK) Ltd.
(Rapra Technology Ltd.; Plastics & Rubber Weekly)

Thermoplastic polyester elastomers (TEEEs) were first developed by DuPont in 1960 and commercialised as Hytrel. Since that time the range of different grades has expanded rapidly and polyester elastomers are now available from several manufacturers. The unique combination of strength, elasticity, toughness and environmental resistance has ensured steady growth, and even after 25 years the market is still expanding at around 10%/year. Most of this growth is fuelled by the flow of new applications which are being found in areas previously covered by conventional rubber, plastics and metals. It is in the replacement of combinations of these materials that some of the most interesting and value-in-use applications have been developed. A recent trend over the last 5-10 years has been the use of additional compounding processes to modify or enhance the basic grades - for example to improve weathering, heat resistance, abrasion or low-temperature properties; or to match product characteristics more closely with specific end-use requirements or processing demands. There is such a range of speciality grades available that it has become even more important for designers and specifiers to work closely with the polymer suppliers to select the appropriate grade for a particular application.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.729075

Item 301
TPES IN CONSUMER PRODUCTS
Carroll T; von Falkenhayn D
Hanna M.A.,Engineered Materials; Bergmann T.,Kunststoffwerke GmbH
(Rapra Technology Ltd.; Plastics & Rubber Weekly)
The growth of TPE products to replace thermoset rubbers over the last 20 years has been phenomenal, but the features of TPEs has led to new markets for soft flexible materials and the demand for multi components styling, colour and special effects has led to further material development. This has been driven mainly by consumer and cosmetic industry. 2 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE

Accession no.729074

Item 302
TPE ’98. Conference proceedings.

STYRENIC TPES - FULFILLING THE NEEDS IN HIGH TECH MARKETS
Fraser D
Laporte AlphaGary Ltd.
(Rapra Technology Ltd.; Plastics & Rubber Weekly)

Styrenic TPES (SBCs) are repositioned as high performance materials capable of competing with vulcanised rubbers and other high specification TPEs in performance as well as on price. The large number of compounders offering SBCs, most notably the SEBS and SEBS alloy types, bear adequate testament to this fact. Laporte AlphaGary has a long term commitment to the development of the styrenic TPE compound market on a global basis with its Evoprene range. Developments in a number of areas where such compounds have provided cost effective solutions are discussed. These include high temperature resistant, low compression set grades, compounds for the emerging soft-touch market and special compounds designed to process under zero shear conditions. 2 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.729073

Item 303
TPE ’98. Conference proceedings.

A NEW UNIQUE THERMOPLASTIC ELASTOMER WITH ENHANCED PROPERTIES
Lampinen A J
Optatech Corp.
(Rapra Technology Ltd.; Plastics & Rubber Weekly)

A new type of thermoplastic elastomer (TPE) is produced by a method called solid state grafting. Because of the chemical composition and the advanced production method, a unique property combination can be achieved. The TPE is composed of continuous polyolefin phase and a dispersed crosslinked polyacrylate phase. It behaves like a thermoplastic vulcanisate (TPV), but has several valuable properties due to the chemical composition of the dispersed phase, including excellent oil resistance, good weatherability and paintability. The elastomer is a fundamental new concept offered to compounding companies. The properties required by end users can be achieved by compounding base grades with additives, such as oils, mineral fillers and other polymers. The three base grades provide a new alternative with their moderate price and unique properties. Details are given. 8 refs.

FINLAND; SCANDINAVIA; WESTERN EUROPE

Accession no.729072

Item 304
TPE ’98. Conference proceedings.

RECENT ADVANCEMENTS IN THE APPLICATION DEVELOPMENTS OF THERMOPLASTIC VULCANISATES (TPE-V)
Schrooten R
DSM Thermoplastic Elastomers
(Rapra Technology Ltd.; Plastics & Rubber Weekly)

The consumption of TPE-V materials (thermoplastic rubbers) is continuing to increase by 10-12%/year. Such strong growth, year after year, is the result of the growth of existing applications, but even more, by the use of these materials in new applications. The performance of thermoplastic rubber is more and more accepted throughout the different industry segments: automotive, E&E, construction. TPE-V materials are, between all TPE-classes, best positioned as replacement materials for thermoset rubber and soft PVC applications; between all classes of thermoplastic elastomers the TPE-V materials are the thermoplastic rubbers. In the marketplace there are only two global TPE-V suppliers who are strongly active with new application developments, and consequently also with new product developments, often required for new applications. Emphasis is placed on two relatively new application areas for TPE-V materials: thermoplastic rubber/thermoset rubber combinations and foaming of TPE-Vs using water releasing agents.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.729071

Item 305

HIGH PERFORMING POLYETHER COPOLYMER BASED TPUS
Julia J; Savatella D
Merquinsa
(Crain Communications Ltd.)

A general description of the specific nature of thermoplastic PUs (TPUs) is presented, focusing on the characteristics of one of the components, namely the macrodiol or soft segment of a PU. The TPU range developed by Merquinsa is summarised. Special attention is given to the speciality TPUs based on polyether
copolymers and caprolactone-ester copolymers, compared with other conventional polyester and polyester-based TPU. Their characteristics allow them to meet the market needs for a variety of applications: melt coating, as well as extrusion and injection moulding. TPUs - also called thermoplastic PU elastomers, as they are highly elastic thermoplastic materials - are formed by linear polymeric chains in block structures. Such chains contain low polarity segments which are rather long, alternating with shorter, high polarity segments. Both types of segments are linked together by covalent links, so that they actually form block copolymers.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN;
WESTERN EUROPE

Accession no.729046

Item 306

Kautchuk und Gummi Kunststoffe
52, No.4, April 1999, p.272/81
German

TWO-PHASE THERMOPLASTIC ELASTOMERS
- FORMULATION, REACTIVE COMPOUNDING
AND PROPERTY PROFILES
Fritz H G; Cai Q; Bolz U
Stuttgart, Institut für Kunststofftechnologie

This article describes the generation of innovative TPE-two-phase polymers. Ethylene/octene copolymers crosslinked dynamically by means of organosilanes are used as synthetic rubber phase. Grafting, hydrolysis and condensation reactions with the organosilanes are carried out in a twin-screw extruder in the course of a single-stage process. As a result of blend composition and crosslinking strategy the generated TPEs show outstanding property profiles. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.728748

Item 307

Modern Plastics Encyclopedia

LOW-DUROMETER THERMOPLASTIC
ELASTOMERS FIND A GROWTH MARKET IN
SOFT-TOUCH APPLICATIONS
Marshall J
GLS Corp.

Worldwide thermoplastic elastomer usage for 1996 was approximately 2 billion lb, with North America accounting for over 40% of the total. There are six traditional TPE types grouped into two generic classes, block copolymers and thermoplastic/elastomer blends and alloys. Two newly emerging technologies are single-phase metallocene-catalysed polyolefin plastomers and elastomers, and reactor-made thermoplastic polyolefin elastomers.

USA
Accession no.728641

Item 308

Polymer
40, No.13, 1999, p.3657-63

STRAIN RECOVERY MECHANISM OF PBT/
RUBBER THERMOPLASTIC ELASTOMER
Aoyama T; Carlos A J; Saito H; Inoue T; Niitsu Y
Tokyo, Institute of Technology; Tokyo, Denki University

The thermoplastic elastomer (TPE) studied was a 50/50 PBT/poly(ethylene-co-glycidyl methacrylate) rubber blend. This TPE showed excellent strain recovery. A three-dimensional finite element method analysis was used to elucidate the strain recovery mechanisms and these mechanisms were supported by polarised Fourier transform-Raman spectroscopy. 17 refs.

JAPAN
Accession no.727166

Item 309

Rubber News
37, No.12, Sept.1998, p.19-20

THERMOPLASTIC RUBBER FOR PRECISION
& CONTROL

Santoprene thermoplastic elastomer is said to be useful for components making up the highly engineered gear and select shift cable system, providing precision, push and pull movements from the drivers’ gear lever to the five-speed manual gearbox in the Boxster two-seat roadster. In developing this application, system supplier Vofa GmbH & Co.KG replaced various thermoset rubber parts with a 55 Shore A grade of Santoprene rubber. Individual parts can be produced using standard thermoplastic processing techniques, and providing low scrap rates and full recyclability. Various automotive applications of Santoprene are mentioned briefly.

ADVANCED ELASTOMER SYSTEMS; VOFAN
GMBH & CO.KG
INDIA

Accession no.726403

Item 310

European Chemical & Polymer Engineer
Dec.1998, p.56-7

THERMOPLASTIC ELASTOMER SUITS
SHOEMAKER DOWN TO THE GROUND
MacDonald W

One of Germany’s leading manufacturers of high-quality safety footwear, Otter, has changed the production of a successful range of shoes to thermoplastic elastomer composite soles. The reasons behind the change, and the manufacturing technology needed to support it, are described. Otter claims that TPEs combine excellent aesthetics, due to clean and sharp surface definition, with outstanding mechanical properties. They deliver not only the best abrasion resistance, but also the highest tear resistance and superb low-temperature flex performance.
Excellent slip resistance is another important advantage offered by TPE. In Germany alone, approximately 250,000 reportable accidents involving foot injuries occur each year, of which 120,000 are caused by slipping. Details are given.

OTTER
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.724242

Item 311
Injection Molding
7, No.1, Jan.1999, p.56
TPE’S FOR OVERMOLDING WIDE RANGE OF RESINS
Maniscalco M
This article looks at the growing demand for soft-touch grips and parts in many applications, and how thermoplastic elastomer (TPE) material suppliers are working to match the chemical compatibility of their products with a greater number of rigid substrate resins for better adhesion. The article highlights in particular the “Tekbond” family of TPE’s for over-moulding, from Teknor Apex of the USA.

TEKNOR APEX
USA
Accession no.723618

Item 312
Plastics News International
March 1999, p.29-30
TPES MAKE GAINS IN AUTO SEALS, UNDERHOOD PARTS
Advanced Elastomer Systems’ thermoplastic vulcanisates are reported to be increasingly replacing EPDM rubber in automotive seals and under-the-bonnet applications. Details are given of specific automotive applications for Santoprene TPV, including static and dynamic seals and weather stripping, and nylon-bondable grades in air induction systems. A further automotive application for an AES thermoplastic rubber is Geolast nitrile rubber/PP TPV in fuel filler grommets.

ADVANCED ELASTOMER SYSTEMS LP;
MITSUBISHI MOTORS CORP.
JAPAN; USA
Accession no.723035

Item 313
Molding Systems
57, No.2, Feb.1999, p.8-9
RUBBER MATERIALS MOULD LIKE THERMOPLASTICS
Alcryn melt-processable rubbers from Advanced Polymer Alloys are said to provide the physical characteristics of thermoset rubbers, while allowing processing on standard thermoplastic injection moulding machines. The materials provide good durability, weatherability, chemical resistance, ageing resistance and colourability. Automotive applications include windshield and backlight mouldings, door-latch seals, fuse holders, fuel filler gaskets, seat belt guides and hinge bumpers.

ADVANCED POLYMER ALLOYS
USA
Accession no.721096

Item 314
Chemie-Ingenieur-Technik
67, No.5, May 1995, p.562-569
German
NEW THERMOPLASTIC ELASTOMERS: FORMULATION, COMPOUNDING AND MATERIAL PROPERTIES
Fritz H-G
Stuttgart,University
New thermoplastic elastomers are described, consisting of a PP matrix and a synthetic rubber phase crosslinked in a new way with organosilanes. The mechanical and rheological properties of the blend are determined primarily by the phase structures produced in the course of compounding. Ultra-low-density polyethylene (PE-ULD) can also be used as the elastomer phase instead of EP(D)M, with the attendant advantage of reduced swelling in oil. 9 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.716849

Item 315
Plastverarbeiter
46, No.4, April 1995, p.88-90
German
FOR HIGH-GRADE TPE MOULDED PRODUCTS
Steimel W
Advice is given on mould optimisation, injection and equipment aids for processing of thermoplastic elastomers. Information is given on steel grades for use in injection moulding machines, recommended injection moulding temperatures for standard types of Santoprene, and factors of mould design and processing for the correction of shrinkage in injection moulding of Santoprenes. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.716846

Item 316
Kunststoffe Plast Europe
88, No.12, Dec.1998, p.11-12,2170-2
THERMOPLASTIC VULCANISATE (TPV) FOAMING WITH WATER-RELEASENING COMPOUND
Wang Y; Cai H; Freitas L; Dion B; Brzoskowski R
DSM Thermoplastic Elastomers Inc.
Using a new chemical foaming technology which used a water-releasing compound as blowing agent, low-density foamed TPV (Sarlink) profiles were produced on conventional single-screw extruders without additives or complex injection systems. The density of the profile was particularly low and could be varied by changing the barrel temps. and screw speed. The profiles had uniform, fine, closed cell structure with a smooth surface. The cell structure, density and physical properties of the foams could also be affected by other foaming conditions, such as take-up speed.
USA
Accession no.713571

Item 317
Modern Plastics International
THERMOPLASTIC ELASTOMERS ARE TARGETED FOR FILM PACKAGING, TECHNICAL MOULDINGS
Styroflex BX 6105 thermoplastic elastomer from BASF is a styrene-butadiene copolymer with a Shore A hardness of 84. The material is targeted at thin films for food packaging, as an alternative to flexible PVC. Optatech’s new Pacrel TPE behaves like a thermoplastic vulcanisate, but the inclusion of the polyacrylate gives it excellent oil resistance, good weatherability and paintability.
BASF AG; OPTATECH CORP.
EUROPEAN COMMUNITY; EUROPEAN UNION; FINLAND; GERMANY; SCANDINAVIA; WESTERN EUROPE
Accession no.714508

Item 318
Journal of Vinyl and Additive Technology
4, No.4, Dec.1998, p.259-65
PROPERTIES OF A THERMOPLASTIC ELASTOMER DERIVED FROM POLYACRYLATE/PVC
Rehm T
Vinnolit Kunststoff GmbH
The polymerisation of vinyl chloride in the presence of suitable elastomer dispersions yielded so-called PVC graft polymers. These could be processed on standard PVC equipment into flexible articles having a high mechanical strength and good indentation recovery. The ultimate physical properties are governed largely by the separation during processing into PVC-rich and elastomer-rich phases. For a polymer of polybutyl acrylate and PVC, this separation is examined by means of DMA. A method is presented by use of which it is possible quantitatively to classify the PVC molecules on the basis of grafted and ungrafted fractions as well as the respective sizes of the domains. The method allows the influence of processing conditions on stiffness, hardness, TS and EB to be explained. Furthermore, reversible and irreversible property changes are shown to occur during reprocessing of test specimens. 15 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.713782

Item 319
Vinylytec ’98. Retec proceedings.
42C382
TPES FROM PVC BLENDS
Weng D; Morin P; Saunders K; Andries J
Teknor Apex Co.
(SPE, Vinyl Div.)
Teknor Apex has developed a new class of thermoplastic elastomers based on advanced PVC blend technology. Like most of the TPEs, these new TPEs (PVC elastomers) represent multiphase blend systems. These PVC elastomers can be processed via conventional processing, such as injection moulding, extrusion and blow moulding. These TPEs are very soft, and show combination of very low compression set and good oil resistance. Their resistance to compression set is demonstrated to be among the best and resistance to most industrial fluids is superior to most TPEs. A 62 Shore A melt processible rubber (Alcryn 60 A) is said to be the softest oil resistant TPE with a compression set of 53% (100 deg.C/22hrs). This new family of PVC elastomers complements those that are already used in the market. In addition, it offers a combination of other desirable attributes that has not been previously attainable, i.e., very soft materials with low compression set and good fluid resistance. Some grades of PVC elastomer are formulated to give excellent low temperature properties that are close to that of TPEs from olefinic and styrenic block copolymers. These TPEs can also be flame retarded to be useful in wire and cable or similar applications. 4 refs.
USA
Accession no.713505

Item 320
Materiaux & Techniques
96, Nos.11-12, Nov./Dec.1998, p.52
French
SHOCK ABSORBING SLEEPERS FOR RAILWAY TRACKS
Daykin S
DuPont (UK)
Trains passing over tracks produce vibrations which can cause sleepers to crack and ballast to crumble which can affect the track alignment. To combat this, shock absorber plates are placed between the rails and sleepers.
These have traditionally been made of supple materials, like rubber and EVA, which are compressed as they absorb the vibrations. However, these pads eventually become permanently deformed or become brittle and cracked at extremes of temperature and need to be replaced. The Norwegian train company NSB has been the first to use shock absorbers made of Hytrel, a thermoplastic elastomer by DuPont, and manufactured by Biobe AS. The Hytrel shock absorbers work by torsion rather than compression. The plates are injection moulded and have raised circular bumps on both sides which are positioned in a staggered arrangement to the bumps on the reverse face. Hytrel plates are recyclable, as quick to produce as rubber plates, are more energy efficient to produce and can be made thinner yet are more resilient to impacts and temperature changes. They can also be different coloured.

DUPONT (UK); BIOBE SA
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.713470

Item 321
Rubber Technology International
1998, p.70/4
INNOVATIVE BLENDING TECHNIQUES CREATE FLEXIBILITY FOR TPE COMPOUNDERS
Kramer J; van der Groeb B; Billiet J
Bennet BV

Bennet’s patented reactive compounding technology enables chemical binding between a large variety of different polymers. The company has recently achieved substantial results in polymer-elastomer blends and has entered the thermoplastic elastomers market with two series of products. Propyrene SP SBS/PP block copolymers are based on virgin raw materials, while Bennetire is a TPE based on SBR/NR grind originating from truck tyres.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.713208

Item 322
Rubber Technology International
1998, p.11-4
PU RISES TO THE OCCASION
Lyszkowski A
London International Group

When London International Group launched the world’s first make PU condom, Durex Avanti, it was the culmination of more than 10 years’ work. This article describes the development work required to perfect a PU that could be used in condom production to eliminate the odour and lack of sensitivity objections to the use of NR latex. A thermoplastic PU elastomer was developed, Duron, which has double the tensile strength of NRL with a 100% modulus of about 2.3MPa. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.713197

Item 323
ACS Polymeric Materials Science and Engineering.
ADVANCED THERMOPLASTIC Vulcanisates Bondable to Nylon
Sadeghi R; O’Connell M; Clare D
DSM Thermoplastic Elastomers Inc.

Power tools, electronics, appliances and sports goods demand soft-touch surfaces for ergonomics, personal comfort and styling. In these applications, low hardness adhesive thermoplastic vulcanisates (TPVs) can be utilised. TPVs based on PP and EPDM are non-polar in nature, which makes their adhesion to polar materials such as nylon a considerable challenge. In the past, mechanical interlocking was used to produce overmoulded TPVs onto the polar substrates used in these applications. Today, a new generation of TPVs can bond to nylon 6, 66, nylon blends with ABS and/or PP. These materials can be processed via insert injection moulding, two-shot injection moulding, and coextrusion. These nylon bondable grades are based on Sarlink 3000 series technology and offer characteristics similar to the 3000 series products. These new products offer excellent temperature and fluid resistance properties similar to the standard TPVs. The concept of a new TPV bondable to nylon offers design engineers vast new options in designing combinations of soft skin to hard segment applications.

USA
Accession no.712621

Item 324
ACS Polymeric Materials Science and Engineering.
THE USE OF TPVS IN PRESSURE Thermoplastic Hose Constructions
Hill M C; Ouladi T
Advanced Elastomer Systems LP; Advanced Elastomer Systems NV/SA

Engineered thermoset and thermoplastic elastomers have been used successfully in hose constructions for the transfer of gas, liquid and solid materials as well as for the transmission of energy. Elastomers have been used to provide flexibility to the hose construction while improving strength for burst resistance in both static and dynamic applications. This balance of performance in elastomeric properties must also accommodate hose
motion, misalignment, vibration and portability. Flexibility of the hose is very important to enable easier routing and installation. Fittings and couplings are attached to the hose ends to facilitate connection of the hose to a pressure source. The requirements for the elastomeric components vary considerably depending on the end use applications. Historically, the most demanding applications have been in the transfer of hydraulic fluids. The requirements for these hose constructions are typified by high working pressures, a wide use temperature range and fluid resistance. Factors which affect the life of a hose are: flexing below the minimum bend radius, twisting, kinking, crushing and abrading the construction. The use of flexible TPVs (thermoplastic vulcanisates) as replacement materials for other engineered thermoset and thermoplastic elastomers in hydraulic hose constructions and specialty fluid transfer applications is described.

References and Abstracts

IN DYNAMICALLY CROSSLINKED POLYPROPYLENE/EPDM BLENDS
Fortelny I; Krulis Z
Czech Republic, Academy of Sciences

It is demonstrated that PP/EPDM blends with fine and uniform phase structure and high impact strength can be prepared by a proper control of dynamic crosslinking. The method is based on the knowledge of the phase structure development in uncrosslinked PP/EPDM blends and the course of curing. It is also shown that the differences between rheological properties of dynamically crosslinked and uncrosslinked blends can be explained as a consequence of entanglements between different domains of the elastomer. 9 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE
Accession no. 712180

Item 325
Boston, Mass., 23rd-27th Aug. 1998, p. 120-1. 012

VISCOELASTIC PROPERTIES OF THERMOPLASTIC ELASTOMERS
Prut E V; Kompaniets L V; Yerina N A
Russian Academy of Sciences

A class of polymer blends known as thermoplastic elastomers (TPE) is of both fundamental and applied importance. The best way to produce TPE comprising vulcanised elastomer in melt processable plastic matrices is by dynamic vulcanisation. The combined mixing/ vulcanisation process leads to the formation of a heterogeneous structure in which the vulcanised elastomer particles with dimensions of the order of 1-10 μm are dispersed in a continuous thermoplastic polymer matrix. The content of elastomer exceeds that of the thermoplastic. The mechanism of TPE deformation is insufficiently studied, and it is still unclear why the room temperature mechanical properties of TPE are determined by the disperse phase rather than by the matrix. The effects of the deformation rate and temperature on the viscoelastic properties of TPE are examined. 4 refs.

RUSSIA
Accession no. 712618

Item 326

CONTROLLING MORPHOLOGY, IMPACT STRENGTH AND RHEOLOGICAL PROPERTIES
Fortelny I; Krulis Z
Czech Republic, Academy of Sciences

It is demonstrated that PP/EPDM blends with fine and uniform phase structure and high impact strength can be prepared by a proper control of dynamic crosslinking. The method is based on the knowledge of the phase structure development in uncrosslinked PP/EPDM blends and the course of curing. It is also shown that the differences between rheological properties of dynamically crosslinked and uncrosslinked blends can be explained as a consequence of entanglements between different domains of the elastomer. 9 refs.

CZECH REPUBLIC
Accession no. 712180

Item 327

FRACTURE BEHAVIOUR OF DYNAMICALLY Vulcanised THERMOPLASTIC ELASTOMERS
Lesser A J; Jones N A
Massachusetts, University

Dynamically vulcanised EPDM/PP thermoplastic elastomers (EPTPEs) have gained significant interest due to their complex morphologies and unique properties. Excellent discussions showing the range of morphologies and basic properties that can be obtained with EPTPE alloys have been reported. An attempt is made to describe the energetics and micro-mechanisms of fracture in a model EPTPE subjected to a Mode I loading condition on a relatively thin specimen. For ductile materials, two approaches are used in order to characterise the fracture behaviour. The most widely used parameter for characterising the fracture in ductile materials is the J-integral approach. Traditionally, fracture characterised by this method requires that the specimen must meet a certain size constraint in order to generate a plane-strain condition. A second approach the Essential Work method. In this method, the total work of fracture is considered to be made of two components - one associated with the initiation of the instability (essential part) and the other associated with the plastic deformation in the plane-stress condition (non essential part). The use of J-integral methods to characterise the fracture behaviour of these materials conditions is investigated, as is the damage that occurs in the process zone of the crack tip and discuss its scale with relation to the morphology of the EPTPE. 6 refs.

USA
Accession no. 712177
Dynamically vulcanised thermoplastic elastomers (TPEs), are heterophase blends of an elastomer crosslinked in situ during melt mixing with a compatible thermoplastic at elevated temperatures. The resulting blends consist of finely dispersed micron-sized elastomer particles of a high crosslink density in a thermoplastic matrix. For the most part, these speciality TPEs have many of the elasticity characteristics of vulcanized rubber at ordinary temperatures but they are also sufficiently thermoplastic in nature at melt temperatures of the thermoplastic phase. They have therefore been steadily replacing traditional thermostet rubber in many applications because of their fabrication ease as well as recyclability. Several publications have appeared covering compositions, various physical and performance attributes of dynamically vulcanised alloys, as well as morphology and rheology. Surprisingly, however, only recently have some detailed studies begun on fracture characteristics and none has yet been reported on the rubbery fracture behaviour of dynamically vulcanised TPEs consisting of blends of PP with relatively large amounts of crosslinked elastomer and oil. The fracture characteristics of a soft dynamically vulcanized EPDM-PP TPE are compared with its analogue using NR. On the basis of the behaviour in normal vulcanisates, it is expected that the strength properties of the NR-based material should be better. 11 refs. EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.712176

Thermoplastic vulcanisates (TPV) are blends of thermoplastic matrix with a crosslinked rubber. The rubber is dynamically crosslinked during blending. Due to this procedure it is possible to get phase inversion and disperse a large amount (up to 80%) of rubber into a thermoplastic matrix. These materials, which are based here on PP and EPDM, show high elasticity upon tension and pressure. This, despite the fact, that the matrix consists of PP, which should be deformed plastically. A large variety of model compounds is prepared, where the amount of PP, crosslink density and the amount of aliphatic oil are varied. The technique used to investigate the deformation behaviour is a combination between infrared spectroscopy and stress-strain measurements. The orientation of different chemical groups during stretching is measured in situ. To prevent over-absorption (the measurements are done in transmission), the measured films have a thickness of 50 pm. The material is stretched up to 200% strain and then recovered until the stress is zero again. This gives a measure for the remaining strain. One of the main advantages of this technique is the fact that the different blend components and also crystalline and amorphous phases of the two polymers can be investigated separately. One example of a sample with 30% PP and 70% EPDM plus crosslinking agent is shown.

EUROPEAN COMMUNITY; EUROPEAN UNION; RUSSIA

Accession no.712175

Thermoplastic elastomers (TPE) based on mixtures of polyolefin elastomers with polyolefin thermoplastics have many of the properties of elastomers, but are processable as thermoplastics. The TPE comprises finely divided elastomer particles dispersed in a relatively small amount of plastic. The elastomer particles should be crosslinked to promote elasticity. PP is a semi-crystalline widely used polyolefin elastomers with polyolefin thermoplastics have advantages of this technique is the fact that the different blend components and also crystalline and amorphous phases of the two polymers can be investigated separately. One example of a sample with 30% PP and 70% EPDM plus crosslinking agent is shown.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.712175
Advanced Elastomer Systems LP

The science and technology of thermoplastic vulcanisates (TPVs) is based on melt blending an elastomer in a thermoplastic and subsequently dynamically vulcanising the rubber phase. The desired morphology of such a multiphase polymer system is finely dispersed, micron sized rubber particles in a continuous plastic phase. There are several key variables governing the morphology and hence the resultant elastomer properties, i.e., the type of plastic, the type of rubber, their relative surface energies, viscosity ratios and the extent of crosslinking of the rubber phase. There are other compounding material ingredients such as process oils or plasticisers, fillers and additives which can modify either the plastic or rubber phases, or both, resulting in properties meeting specific performance needs. The majority of the commercially known thermoplastic vulcanisates as a class of thermoplastic elastomers, are based on PP and EPDM rubber. Other elastomers researched for TPVs include polyisobutylene-co-isoprene, NR, NBR and brominated paramethyl styrene-isobutylene copolymer (BIMS). The effect of compatibiliser level, compatibiliser type and olefinic rubber type are investigated. Physical properties and high temperature performance are evaluated. 10 refs.

USA
Accession no. 712168

**Item 332**

**INNOVATIVE THERMOPLASTIC VULCANISATES: FORMULATION, MORPHOLOGY, PROCESSING AND PROPERTIES**
Fritz H G
Stuttgart, University

With two-digit annual growth rates, thermoplastic elastomers belong to the most rapidly developing polymeric systems. A new type of polyolefin blend, thermoplastic vulcanisates (TPV), are discussed. TPV is a two-phase polymer system that consists of a continuous PP matrix and a synthetic rubber phase. The latter is in a form of microdispers phase and highly crosslinked. At room temperature these blends show a rubber-like behaviour, still maintaining thermoplastic processing characteristics - a significant advantage with respect to recycling. The innovative steps that lead to materials with enhanced performance comprise: replacement of EPM or EPDM copolymer by saturated metallocene-catalysed ethylene/octene copolymer, modification of the elastomeric phase crosslinking by the use of organosilanes, and generation of two-phase polymers in an optimised single-stage process using a co-rotating intermeshing twin-screw extruder. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no. 712167

**Item 333**

**NEW HIGHLY CROSSSLINKED TPES BASED ON VNB-EPDM**
Ellul M D; Ravishankar P S
Advanced Elastomer Systems LP; Exxon Chemical Co.

VNB-EPDM has previously been suggested for obtaining highly crosslinked EPDM by peroxides. However, it has not been possible to obtain such a polymer due to incipient gelation as a result of the long chain branching (LCB) by Ziegler polymerisation of the pendant double bond, if a diene such as vinyl norbornene (VNB) is used in place of the more common ethylidene norbornene (ENB). Recently a gel-free process for incorporating VNB in the EPDM backbone has been developed, resulting in a polymer with a high degree of controlled LCB by Ziegler polymerisation of the VNB pendant double bond. This type of LCB is not achievable in ENB-EPDM, whose branching is obtained through cationic coupling of the pendant double bond in ENB. For peroxide crosslinking, it is advantageous to use VNB, since it is a substantially more efficient termonomer, producing high states of cure at low concentrations of both the VNB diene and peroxide. Reduction in the diene content through the use of the reactive VNB termonomer improves the EPDM heat ageing because of less unsaturation, while lower peroxide requirements reduces overall compound cost for the end user. Furthermore, for TPEs made by dynamic vulcanisation of EPDM-PP, the lower the peroxide concentration necessary to produce highly crosslinked TPES, the less the degradation of PP by random chain scission. 9 refs.

USA
Accession no. 712166

**Item 334**

**AN OIL RESISTANT THERMOPLASTIC VULCANISATE FROM EPOXIDISED NATURAL RUBBER AND POLYPROPYLENE**
Patel J; Tinker A J
Tun Abdul Razak Research Centre

Thermoplastic vulcanisate (TPV) is one of a number of names given to thermoplastic elastomers comprising a blend of one or more dynamically vulcanised rubber phase(s) and a thermoplastic phase. Although a large number of combinations of elastomers and thermoplastics have been investigated, the majority of the materials which have found utility, and hence commercial success, contain a polyolefin, particularly PP, as the thermoplastic component. Epoxidised NR, ENR, is a chemically-
modified form of NR formed by reaction with peroxycarboxylic acid to give a copolymer comprising cis-1,4-polyisoprene with cis-epoxide groups randomly distributed along the polymer backbone. Whilst a wide range of compositions can be made, ENR is available commercially at modification levels of 25 and 50 mol.%. A TPV has been developed from ENR and PP. Aspects of this material, thermoplastic epoxidised NR (TPENR), revealed by the use of new characterisation procedures, and some of its virtues are examined. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.712165

Item 335

DYNAMIC VULCANISATION - A MAJOR INNOVATION IN TPES
Abdou-Sabet S
Advanced Elastomer Systems LP

Dynamic vulcanisation is a process that embraces the curing of the rubber component of a rubber/plastic blend under mixing conditions generating a fine dispersion of small rubber particles in a plastic matrix. Dynamic vulcanisation was discovered in an attempt to improve the impact strength of PP through partial crosslinking of a butyl rubber component. Thermoplastic elastomer compositions made of EPDM and isotactic PP through partial Vulcanisation of the EPDM phase were later claimed. Significant improvement in the properties of these blends was achieved in 1978 by fully vulcanising the rubber phase under dynamic shear without affecting the thermoplasticity of the blend. This concept was further improved to achieve true rubber-like properties and provided further improvement in processability that allows the successful commercialisation of these types of materials. Aspects covered include preparation and morphology, effect of crosslinking on properties and effect of plasticisers. 10 refs.

USA

Accession no.712164

Item 336
London, c.1998, pp.17, 16cms. 31/12/98

KRATON G COLLECTION
Shell Chemicals

An information pack from Shell Chemicals highlights the versatility of Kraton G styrene-ethylene butylene-styrene block copolymers. A series of compounds provides hardnesses between 10 and 90 Shore A, with a performance temperature of between -65C and +120C. Examples are given of its use by European compounders to add rubbery softness, flexibility, clarity and smoothness of surface finish to products ranging from cars, appliances, toys and housewares to medical devices, leisure goods, and electrical equipment.

THERMOPLASTIQUES COUSIN-TESSIER; MULTIBASE; SOCIETE INDUSTRIELLE DES ETABLISSEMENTS LOUIS-ANDRE CHAIGNAUD; GUMMIWERK KRAIBURG GMBH & CO.; API; WITTENBURG BV; POLIBASA; EVODE PLASTICS LTD.; ELASTOTEKNIK; DRYCOLOR; NESTE POLYMER COMPOUNDS
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; ITALY; NETHERLANDS; SCANDINAVIA; SPAIN; SWEDEN; UK; WESTERN EUROPE

Accession no.712087

Item 337
Bound Brook, N.J., 1990, pp.9. 28cms. 31/12/98

FLEXOMER POLYOLEFINS : A BRIDGE BETWEEN POLYETHYLENE AND RUBBERS
Rifi M R; Ficker H K; Corwin M A
Union Carbide Chemicals & Plastics Co.Inc.

Flexomer polyolefins are a unique class of thermoplastic polyolefins which resemble rubbers in flexibility while having the toughness of polyethylene. These characteristics are due to a combination of low density and high molecular weight. This paper describes the main features of, and typical applications for Flexomer grades and also tabulates general and specific properties. Their use in films promotes good puncture, dart drop and tensile strength properties, while blending Flexomer with isotactic polypropylene produces TPOs with various combinations of stiffness and low temperature impact properties on a cost/performance basis. The Flexomer range is particularly suitable for use in hose and tubing applications, displaying outstanding flexibility and toughness when compared with EVA and plasticised vinyl resins. 7 refs.

USA

Accession no.712081

Item 338
Canadian Plastics
56, No.12, Dec.1998, p.11

THERMOPLASTIC ELASTOMERS - EXTREME PERFORMANCE

This article examines the many advantageous properties of the newest grades of thermoplastic elastomers (TPE’s), which are stronger, softer, clearer and more elastic than ever before. Examples are given throughout of applications for these new TPE’s.

BAYER; TEKNOR APEX; DUPONT DOW ELASTOMERS; ADVANCED ELASTOMER SYSTEMS; ALPHAGARY CORP.; PLASTITEC; GLS CORP.; BASF; NEOPTX INC.
MEXICO; USA

Accession no.711893
TPE'S BASED ON OLEFINS, STYRENICS, BOND TO WIDE RANGE OF THERMOPLASTICS

Mapleston P

This article focuses on new developments in the field of thermoplastic elastomers (TPE's) based on polyolefins and styrenics. It highlights two new extrusion grades from Riken Vinyl Industry Co. Ltd. of Japan, in the company’s Ultrasofen Actymer 2000 Series, and also soft-touch TPE’s from Japan’s Taisei Plas Co. that bond well to a wide range of rigid thermoplastics. Full details are given.

TAISEI PLAS CO.; RIKEN VINYL INDUSTRY CO.LTD.; MITSUBISHI CHEMICAL CORP.
JAPAN; USA
Accession no.711869

OLEFIN-BASED NANOCOMPOSITES HOLD POTENTIAL FOR AUTOMOTIVE

Grande J A

Montell North America and General Motors Research and Development have developed thermoplastic olefin elastomer-based nanocomposites which are claimed to offer great potential for expanding the use of plastics in automotive applications, especially in large structural applications, it is reported. The breakthrough technology is claimed to be the first development of nanocomposites in non-polar materials. Advantages of the materials are discussed.

MONTELL NORTH AMERICA; GENERAL MOTORS CORP.,R & D CENTER
USA
Accession no.711760

THERMOPLASTIC ELASTOMERS FROM BLENDS OF POLYSTYRENE AND NATURAL RUBBER. MORPHOLOGY AND MECHANICAL PROPERTIES

Asaletha R; Kumaran M G; Thomas S
Rubber Research Institute of India; Mahatma Gandhi University

Morphology and mechanical properties of NR/PS blends were analysed with special reference to the effect of blend ratio, processing conditions and vulcanising systems. The mechanical properties and morphology of the blends were dependent on the processing conditions, i.e. whether the samples are prepared by the melt mixing technique (Brabender plasticorder) or by solution casting. Three different solvents, namely, chloroform, benzene and carbon tetrachloride were used as the casting solvents. Differences in mechanical and morphological properties were observed in each case which in turn depended upon the interaction of the solvent with the constituent homopolymers. Attempts were made to correlate the morphology with properties. Experimental values were compared with different theoretical models. The effects of dynamic crosslinking using sulphur, peroxide, and mixed systems on morphology and mechanical properties of NR/PS blends were also studied. Data include density, molecular weight, cure system, domain sizes, stress strain curves, EB, TS, tear strength, tensile impact strength and Youngs modulus as well as SEM and optical micrographs to show morphology. 35 refs.

INDIA

Accession no.711588

POLYAMIDE BASED THERMOPLASTIC ELASTOMERS

Judas D; Flat J J; Dousson C
Elf Atochem SA; Elf Atochem-Cerdato
(AFICEP; Societe de Chimie Industrielle)

An examination is made of the structure of Elf Atochem’s Pebax ether-amide block copolymer thermoplastic elastomers and similar polyamide elastomers produced by other manufacturers. The synthesis of Pebax elastomers by a two-stage polycondensation process is described, and the dependence of their properties on composition and structure is discussed. 9 refs.

HULS AG; EMS CHEMIE AG; UBE INDUSTRIES LTD.; HUNTSMAN CHEMICAL CORP.
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; JAPAN; SWITZERLAND; USA; WESTERN EUROPE
Accession no.710625
THERMOPLASTIC ELASTOMERS FOR GLAZING SEALS - AN OPPORTUNITY FOR THE PVC PROFILES EXTRUSION INDUSTRY
van der Loo L L H
DSM Thermoplastic Elastomers
(Applied Market Information Ltd.; European Plastics News)

Thermoplastic elastomers (TPE’s) have made considerable progress this decade as seals in the rigid PVC profiles industry, and their influence is still growing. This paper takes a detailed look at the present status of TPE profiles in the window gasket industry.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.706744

FLUORINATED THERMOPLASTIC ELASTOMERS FOR HIGH TEMPERATURE APPLICATIONS
Arcella V; Brinati G; Albano M
Ausimont SpA
(AFICEP; Societe de Chimie Industrielle)

Thermoset fluorocarbon elastomers (FKM) are used in automotive, chemical and aerospace industries to produce shaft seals, O-rings and hoses, used in hostile environments in terms of both broad temperature range and contact with aggressive chemicals. It is well known that thermoplastic elastomers, compared with thermoset elastomers, produce scrap during processing that may easily be recycled and less volatile due to the absence of chemical curing reactions. The most common fluorinated thermoplastic elastomers are block copolymers, produced using a special free radical polymerisation process called ‘pseudo-living’ polymerisation. Block polymerisation is performed, taking advantage of an unusual kinetic behaviour of the polymerisation of fluorinated monomers in the presence of iodo-substituted fluorocarbons. 6 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.706214

ANALYSIS OF THERMOPLASTIC ELASTOMERS BY INFRARED SPECTROSCOPY. I.
Ramirez E; Huerta B; Sanchez M; Zamora J
Centro de Investigacion en Quimica Aplicada

Results are presented of a study of the pyrolysis products of a range of thermoplastic elastomers by Fourier transform IR spectrophotometry. Most of the spectra rubber industry. This is because these materials have many of the properties of rubbers, but they can be processed as thermoplastics, without the need for costly vulcanisation. All that is necessary to fabricate finished elastomeric parts is to start with pellets as a feed for rapid forming techniques such as thermoplastic extrusion, thermoplastic injection moulding, thermoplastic calendering, etc., without the need for vulcanisation in a mould, lead press, hot bath, etc. In addition, some thermoplastic elastomers can be directly blow moulded or thermoformed into finished articles. It is also possible to thermally weld TPEs. Used or rejected TPE articles can be reground and directly recycled due to their thermoplasticity, in contrast with conventional vulcanised rubbers. An overview of TPE development is presented.
USA
Accession no.706217

ANALYSIS OF THERMOPLASTIC ELASTOMERS BY INFRARED SPECTROSCOPY. I.
Ramirez E; Huerta B; Sanchez M; Zamora J
Centro de Investigacion en Quimica Aplicada

Results are presented of a study of the pyrolysis products of a range of thermoplastic elastomers by Fourier transform IR spectrophotometry. Most of the spectra rubber industry. This is because these materials have many of the properties of rubbers, but they can be processed as thermoplastics, without the need for costly vulcanisation. All that is necessary to fabricate finished elastomeric parts is to start with pellets as a feed for rapid forming techniques such as thermoplastic extrusion, thermoplastic injection moulding, thermoplastic calendering, etc., without the need for vulcanisation in a mould, lead press, hot bath, etc. In addition, some thermoplastic elastomers can be directly blow moulded or thermoformed into finished articles. It is also possible to thermally weld TPEs. Used or rejected TPE articles can be reground and directly recycled due to their thermoplasticity, in contrast with conventional vulcanised rubbers. An overview of TPE development is presented.
USA
Accession no.706217
obtained showed characteristic signals for each constituent, and the combination of IR spectrophotometry with thermal analysis techniques such as DSC and TGA allowed the exact identification of the samples. 11 refs.

**MEXICO**

*Accession no. 702530*

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**Item 349**

154th ACS Rubber Division Meeting - Fall 1998. Conference preprints.

**SBR/PVC BLENDS WITH NBR AS A COMPATIBILISER**

Zhao J; Ghebremeskel G N; Peasley J
Ameripol Synpol Corp.
(ACS, Rubber Div.)

The properties of thermoplastic elastomers (TPEs) based on blends of PVC and divinylbenzene (DVB) crosslinked, hot polymerized emulsion SBR are investigated. Optimisation of the properties of the SBR/PVC/NBR blends using experimental parameters such as blending time, mixing type, processing temperature, polymer ratio, acrylonitrile content of NBR and polymer Mooney viscosity is studied. Finally, important TPE properties such as mechanical properties, compression set and heat ageing of the SBR/PVC/NBR blends are compared to results reported in the literature. 31 refs.

**USA**

*Accession no. 701923*

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**Item 350**

154th ACS Rubber Division Meeting - Fall 1998. Conference preprints.

**NBR AND ACRYLATE-BASED TAILOR MADE TPES**

Stockdale M; Tandon P; Bush J
Goodyear Tire & Rubber Co.
(ACS, Rubber Div.)

Two polymers used for plastics modification are discussed. These polymers are in a fine powder form for blending with polar plastics, of which plasticised PVC is the most important. They have been developed for easy thermoplastic melt processing characteristics, and a number of grades are available for a variety of applications. The first polymers discussed include Goodyear’s Chemigum NBR products. They are butadiene-acrylonitrile copolymers containing 33% acrylonitrile. Their use results in improvements in specific physical properties including dynamic properties, as well as oil and fuel resistance. The second product is Sunigum, an acrylate terpolymer designed for improvements in heat, UV and oil resistance while imparting a unique soft touch to the finished compound. 12 refs.

**USA**

*Accession no. 701922*

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**Item 351**

154th ACS Rubber Division Meeting - Fall 1998. Conference preprints.

**STYRENIC THERMOPLASTIC ELASTOMERS**

Hansen D R; St.Clair D J
Shell Chemical Co.
(ACS, Rubber Div.)

The unique and precise block structure of styrenic block copolymers makes them ideally suited for a variety of performance applications: modified asphalts, adhesives, compounds and polymer modification. The micro-phase separated block structure allows fast thermoplastic processing in molten and solution applications without chemically crosslinking the system. New generations of block copolymers offer new opportunities for an ever-growing market. 10 refs.

**USA**

*Accession no. 701914*

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**Item 352**

154th ACS Rubber Division Meeting - Fall 1998. Conference preprints.

**HIGH PRESSURE THERMOPLASTIC HOSE CONSTRUCTIONS UTILISING THERMOPLASTIC VULCANISATES**

Hill M C; Ouhadi T
Advanced Elastomer Systems LP; Advanced Elastomer Systems NV/SA
(ACS, Rubber Div.)

A thermoplastic hydraulic hose construction is successfully fabricated utilising TPV materials for the cover and as intermediate layers of the tubing assembly. The preferred tube assembly consists of a thin layer of an impact modified nylon 6 or a pure nylon 6 resin to provide resistance to hydraulic oil migration and weepage. This fluid resistant layer is coextruded with a nylon bondable TPV which demonstrates excellent adhesion to nylon materials in the melt phase. The coextrusion of a 0.2 mm thick inner layer of nylon with the nylon bondable TPV as the outer tube layer provides a flexible, fluid resistant, tube construction. The reinforcing layer between the tube and cover is comprised of metallic wires which are braided to provide satisfactory resistance to burst during exposure in moderate to high pressure environments. Adhesion between the elastomeric TPV and the wire reinforcement is achieved through use of specific tie layer adhesives and modified TPV materials. Rubber tearing bonds are achieved between the TPV and the wire through the use of select adhesive tie layers and understanding the surface characteristics of the reinforcement. The hose assembly fabricated using the nylon and TPV tube demonstrates satisfactory performance during extended testing. The hose assembly does not exhibit any weepage of the hydraulic oil after one month testing at 100 deg.C. 4 refs.

**BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE**

*Accession no. 701903*
OVERVIEW/REVIEW OF THERMOPLASTIC ELASTOMERS
McGrath J E
Virginia Tech
(ACS,Rubber Div.)
A review is presented of thermoplastic elastomer technology. It is concluded that what is now a major business may feature new developments in specialised ion-containing elastomers, and specialised applications for high performance polyimide polydimethylsiloxane segmented copolymers may become significant in areas such as electronics and aerospace. 19 refs.
USA
Accession no.701900

GET A GRIP
Warner Tools can now offer a soft-touch grip on its ProGrip paint scrapers. Designers selected Sarlink 3460 thermoplastic elastomer from DSM Thermoplastic Elastomers for the soft grip component. The part is moulded using a two-shot insert-moulding process with two horizontal 88-ton injection presses. Another elastomer product for injection moulding is Alcryn from Advanced Polymer Alloys.
DSM THERMOPLASTIC ELASTOMERS INC.; ADVANCED POLYMER ALLOYS
USA
Accession no.700077

THERMOPLASTIC POLYURETHANES
Zierden M P; Nardo N R
Bayer Corp.
Bridging the gap between plastics and elastomers are thermoplastic PU elastomers (TPUs), rubber-like PU materials combining the processing efficiencies and recyclability of thermoplastics with the superior properties of high-grade PU elastomers. Developed in the 1950s, TPUs feature a chemistry that is a combination of an isocyanate, a high molecular weight resin, and a chain extender. The combination used determines the physical properties and other characteristics of the resulting TPU. The reaction products of the isocyanate with the chain extender are crystalline or semi-crystalline regions which affect rigidity, hardness and high-temperature properties. Amorphous or rubbery regions, formed by the reaction of the high molecular weight resin with the isocyanate, impart elasticity, resilience and low-temperature performance. Details are given.
USA
Accession no.699780

WELL PADDED, INJECTION MOULDINGS FROM CROSSLINKED POLYOLEFIN ELASTOMER FOAMS
Diegritz W
DuPont Dow Elastomers (Deutschland)
The use of injection-moulded crosslinked polyolefin thermoplastic elastomer foams in the manufacture of footwear components and of padding and lining of sports items is discussed. The advantages of this material over the traditionally-used EVA are discussed, with emphasis on low weight, high elasticity, long service life and comfort-enhancing damping properties.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.699042

APILON 33
Applicazioni Plastiche Industriali SpA
Details are given of the Apilon 33 range of thermoplastic elastomer alloys based on PVC and NBR. The materials offer good chemical and ageing resistance, processability, elasticity and colourability. Available in extrusion and injection moulding series, Apilon 33 grades are particularly suitable for the production of opaque products with specific chemical resistance, while other applications include sports and leisure items, shoe manufacture, furnishing parts, building products, automotive interior trim, industrial goods, and aesthetic cables. Food-contact grades are also available. Extrusion and moulding processing parameters are provided, together with guidelines on colouring, recycling, safety, packaging and storage.
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.695608
Thermoplastic PU elastomers are generally used as solvent-based adhesives in the automotive, footwear and furniture industries. In general, different commercial PUs are used to prepare solvent-based adhesives but, due to their unknown formulation, their performance cannot be predicted and variations from batch to batch of the same PU, often give significant different properties. Several parameters determine the segmented structure of PUs, such as the hard/soft segments ratio, the type and structure of raw materials and the preparation procedure, amongst others. The influence of the molecular weight of e-polycaprolactone macroglycol on the structure, properties and adhesion of PUs is analysed by combining several experimental techniques. 22 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; SPAIN; WESTERN EUROPE
Accession no.694808

Item 359
Antec '98. Volume III. Conference proceedings.
Atlanta, Ga., 26th-30th April 1998, p.3204-8. 012
EXTRUSION OF LOW DENSITY CHEMICALLY FOAMED THERMOPLASTIC VULCANISATES
Brzoskowski R; Wang Y; La Tulippe C; Dion R; Cai H; Sadeghi R
DSM Thermoplastic Elastomers (SPE)

During the past year, DSM Thermoplastic Elastomers has developed a revolutionary technology which uses a special chemical ingredient as a blowing agent for producing low-density foamed thermoplastic vulcanisate (TPV) (pending patent application). This technology is capable of producing low-density closed cell foam profiles and sheets on conventional single screw extruders without additives or complex injection systems. The Sarlink foaming grades contain a pre-compounded ingredient which produces water upon heating above the activation temperature in the melt. The resulting foam contains uniform, fine closed cell structure with a smooth surface. Using a single Sarlink foam grade, the specific gravity can be adjusted during processing from 0.15 to 0.90. 11 refs.

USA
Accession no.692467

Item 360
Machine Design
ADDING A SOFT TOUCH WITH NYLON-BONDABLE ELASTOMERS
AlliedSignal Engineering Plastics Inc.; Advanced Elastomer Systems LP

For years engineers have taken advantage of the chemical compatibility of thermoplastic vulcanisates (TPVs) and PP to mould components with rigid and soft sections. A new TPV chemistry now adds the ability to bond TPV to nylon, giving engineers new options for adding a soft touch, flexibility and scaling performance to products that demand higher strength such as sporting goods, automotive components, and appliance knobs and handles. While PP has a good balance of qualities, nylon improves performance by offering high-temperature resistance, stiffness, strength, toughness, and chemical and abrasion resistance. The strong bond created between TPV's and nylon substrates eliminates the need for mechanical interlocks and primers or adhesives. Manufacturers apply soft-touch elastomers to nylon substrates using insert moulding, two-shot injection moulding or coextrusion. Details are given.

USA
Accession no.691797

Item 363
Journal of Applied Polymer Science

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Dynamically vulcanised poly(vinyl chloride)/epoxidised NR thermoplastic elastomers were prepared at 150°C at a rotor speed of 50 ppm. Curative concentration was steadily increased from 0 to 1 phr to study the vulcanisation effect on the plasticised blend. The effectiveness of the dynamic vulcanisation was indicated by Brabender plastograms. Properties investigated include mass swell, tensile strength, EB, modulus at 100% elongation, tear strength, and hardness. The PVC/epoxidised NR samples were exposed to two different types of environments, namely, air and oil under otherwise identical conditions. The effect of oil and thermooxidative ageing on the mechanical properties were characterised at room temperature and 100°C. 27 refs.

DSM Engineering Plastics has introduced a new grade of Arnitel, its range of copolyester thermoplastic elastomers, for use in constant velocity joint boots. Arnitel EB464 has good low temperature fatigue behaviour at -45°C, long term abrasion resistance, and long term high heat and grease resistance up to 100°C. DSM says it processes well on blow moulding equipment. This abstract includes all the information contained in the original article.

Styroflex is a novel styrenic polymer, featuring properties such as high transparency, good processability and recovery (memory effect). Elastomer-like properties result from a linear hard-soft-hard structure, made of styrene, statistical styrene/butadiene and styrene block sequences. The order/disorder transition temperature is as low as 145 deg.C. Thus, Styroflex behaves almost as an ideal Newtonian liquid under typical processing temperatures like 170-200 deg.C. The time-dependent stress-strain curves are similar to plasticised PVC and conventional SBS rubbers. Styroflex is miscible with other styrenic polymers, allowing custom tailored properties. 7 refs.

Applications of thermoplastic elastomers in the automotive industry are discussed, with particular attention to cables for watertight operation, ventilation fixtures, spray protector, water drain, shock absorber covers and oil filler pipes. 7 refs. (Full translation of Gummi Fas.Kunst., No.12, 1997, p.974)

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Applications of thermoplastic elastomers in the automotive industry are discussed, with particular attention to cables for watertight operation, ventilation fixtures, spray protector, water drain, shock absorber covers and oil filler pipes. 7 refs. (Full translation of Gummi Fas.Kunst., No.12, 1997, p.974)
thermoplastic elastomers. Data are given for consumption, growth and applications. Comparisons are made between Vaycron and EPDM.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.684905

**Item 369**

*International Polymer Science and Technology*
24, No.12, 1997, p.T/14-8

**PHYSICAL FOAMING OF ELASTOMERS DURING EXTRUSION**
Meyke J

Details are given of the foaming of a polyolefin thermoplastic elastomer for rubber seals. A single-stage extrusion process was used to manufacture the profiles using a water foaming technique. Translated from Gummi Fas Kunst, No.11, 1997, p.847
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.684805

**Item 370**

Foampas °97. Conference proceedings.
Mainz, Germany, 4th-5th Nov.1997, p.117-31. 6124

**NEW LOW DENSITY TPE-V FOAMS PRODUCED ON CONVENTIONAL PROCESSING EQUIPMENT**
Niemark R
DSM Thermoplastic Elastomers BV
(Schotland Business Research Inc.)

The performance properties of thermoplastic elastomers (TPEs) are derived from their chemistry and morphology. Basically, typical elastomers have a chemical network, due to crosslinking reactions. Therefore, elastomers are in principle not soluble. TPEs can be divided into two groups: block copolymers and elastomeric blends. Block copolymers form physical networks due to crystallisation, ionic association reactions and hydrogen bonding, and the molecular structure of these polymers are based on so called hard and soft segments. Typical TPE block copolymers are styrenics, PUs,polyether esters, polyester esters and the polyetheramides. Elastomeric blends are mixtures of a semi-crystalline plastic (hard component) and an amorphous rubber (soft component). The most common and widely used types of elastomeric blends are composed of PP and EPDM. Emphasis is placed on DSM's Sarlink material. 4 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.683827

**Item 371**

Indianapolis, In., 5th-8th May,1998. Paper 33. 012

**IMPROVED WET ELECTRICAL TPV BASED COMPOSITIONS**

Pfeiffer J E; Waddle C
Advanced Elastomer Systems LP
(ACS,Rubber Div.)

New vulcanisation technology has led to the introduction of novel TPV products that should offer improved performance in the electrical market. Superior wet electrical performance is achieved by combining one such thermoplastic vulcanisate and various additives such as antioxidants, metal deactivators and flame retardants. After six months of continuous immersion in water, several compositions have remained electrically stable and have demonstrated superior performance when compared to one other commercial electrical compound. Compositional details concerning the additives are detailed and disclosed. The improvement in wet electrical performance does not require the addition of traditional lead stabilisers. The testing performed with the TPV based compositions includes wet electrical testing at 75 deg.C, heat ageing, tensile properties, flammability and basic electrical characteristics. This work should lead to improved performance for TPV-based electrical compositions in either jacket or insulation applications. 4 refs.
USA
Accession no.683250

**Item 372**


**PEROXIDE CROSSLINING OF POLYOLEFIN ELASTOMERS**

Cubera M; Bekendam G; Roelofs H
Akzo Nobel Chemicals; Akzo Nobel Central Research
(ACS,Rubber Div.)

Peroxide crosslinking of elastomers dates back almost eighty years. It was not until the development of fully saturated ethylene propylene copolymers in the early 1970s that the technical interest grew in organic peroxides. This new interest in peroxides help foster the development of new types of peroxides and their formulations. These peroxides overcame many of the drawbacks in thermal stability, crosslinking efficiency, handling and safety that existed at that time. In recent years new technology has been introduced which allows the production of polyolefin elastomers. Precise and predictable molecular control is a distinguishing feature of this technology. These new polyolefin elastomers are said to bridge the gap between thermoplastics and elastomers. They have the processing characteristics of thermoplastics and the performance characteristics of elastomers. 3 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; USA; WESTERN EUROPE
Accession no.683223
Item 373
TECH XX. Conference proceedings.
Chicago, Il., 1997, p.189-209. 6A1
HIGH SERVICE TEMPERATURE THERMOPLASTIC ELASTOMER ADHESIVES
Hansen D R; Himes G R; Kiibler K S; Shafer D L
Shell Chemical Co. (Pressure Sensitive Tape Council)
The elevated service temperature for styrenic block copolymer adhesives and sealants has been extended by blending the copolymers with newly developed low molecular weight PPE resins. The new PPE grades significantly increase the glass transition temperature of the PS end-blocks and are very compatible and processable in hot melt and solution applications because of their low molecular weight. 11 refs.
USA
Accession no.677775

Item 374
Materie Plastiche ed Elastomeri
Nos.11/12, Nov./Dec.1996, p.662-3
Italian
NON-HYGROSCOPIC TPV FAMILY FOR COLOURED PRODUCTS
An examination is made of the properties and applications of a new series of Santoprene thermoplastic elastomers, based on PP/EPDM blends, developed by Advanced Elastomer Systems using a new dynamic vulcanisation process. These elastomers (the Santoprene 8000 Series) are non-hygroscopic, have improved colourability, and are available in grades for injection moulding, extrusion and food-contact applications. Other grades in the course of development are also reviewed.
ADVANCED ELASTOMER SYSTEMS
USA
Accession no.677479

Item 375
Journal of Coated Fabrics
Vol.27, Oct.1997, p.105-14
BREATHABLE PROTECTIVE CLOTHING WITH HYDROPHILIC THERMOPLASTIC ELASTOMER MEMBRANE FILMS
Schledjewski R; Schultz D; Imbach K P
Wolff Walsrode AG
The material class of thermoplastic elastomers is described and application of these materials in breathable laminates for garment improvement, especially of protection garments, is discussed. The most important production and manufacturing processes are considered and the relevant properties are presented. Particular attention is paid to thermoplastic PUs as important materials for breathable thermoplastic elastomer films. 4 refs. (Techtextil Symposium 1997, Frankfurt-am-Main, Germany, May 1997)
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.677476

Item 376
Hilton Head, SC, 15th-18th June 1997, p.87-107. 6A1
VERSATILE, HIGH-PERFORMANCE TPE FOR ADHESIVES
Himes G R; Oliveri L H
Shell Chemical Co. (TAPPI)
An examination is made of the structure, properties and applications in hot melt adhesives and sealants of thermoplastic elastomers based on a styrene-ethylene butylene-styrene block copolymer (SEBS) in which each ethylene-butylene block is chemically bonded at the midpoint to two blocks of polyisoprene. The SEBS portion provides stability and high strength and the polyisoprene portion gives tack, peel adhesion and reduced viscosity. The copolymers can be varied in molecular weight and structure without significantly affecting adhesion, and can be used in low polymer content adhesives having a performance approaching that of SEBS formulations with conventional polymer contents. 4 refs.
USA
Accession no.677476

Item 377
Design Engineering
April 1998, p.87-8
WE COULD GET YOU INTO FILMS
Thermoplastic PU (TPU) was discovered in the late 1930s as part of Germany’s World War II research. It is a
thermoplastic elastomer (TPE), which combines the mechanical and physical properties of rubber with the advantages of thermoplasticity and processability. Noted for its high performance and general overall toughness, PU rapidly became the material of choice for a wide range of critical applications. Urethane’s unique characteristics make it an extremely versatile material that outperforms many other thermoplastics. For example, it retains its flexibility even at low temperatures, where PVC becomes brittle. PU combines the best properties of rubber and plastic, without the weaknesses inherent in plasticised vinyl films. Details are given.

STEVEN'S URETHANE; JPS ELASTOMERICS CORP. USA

Accession no.676514

Item 379
Kunststoffe Plast Europe
ECONOMICAL AND EFFICIENT
Diegritz W; Fransson O
Polyolefin elastomers can replace conventional thermoplastics and specific elastomers in numerous applications. They behave as elastomers, but may be processed in the manner of conventional thermoplastics. They have great development potential, especially in the interiors of future car generations. Constituting a link between elastomers and thermoplastics, these ethylene copolymers can be injection moulded, extruded, foamed, thermoformed, blow moulded, calendered, welded and, if required, crosslinked as well. These completely, halogen-free materials have shown their usefulness in slush moulding processes for the production of high-quality car interior surfaces. And because articles produced therefrom range from elastic to rubbery, yet are as flexible in processing as thermoplastics, they open up previously inconceivable applications for polyolefins. 3 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.676367

Item 380
International Polymer Science and Technology
24, No.11, 1997, p.T/1-7
FLEXIBLE EXTRUSION - A NEW PROCEDURE FOR TPE PROCESSING
Koette R
Gepoc Verfahrenstechnik GmbH
A description is given of the flexible extrusion system, a completely new procedure for the application of thermoplastic elastomer seals to rigid substrates. The process is said to enable components with integrated sealing elements, such as vehicle windscreen, to be manufactured simply and inexpensively. The technique involves the use of a die attached to a cylinder, an x-y process, or a robot, so that it can move. The die is guided along the moulding which is to hold the seal, while, fed through the hose, the extrusion process takes place. The profile is thus positioned directly at its place of installation, while it is being manufactured. The die moving around the component explains the term, ‘flexible extrusion’. During extrusion, the joint with the substrate to be coated is constructed, either by welding, bonding or mechanical clamping. (Full translation of GFK, No.9, 1997, p.712)
SEKURIT SAINT GOBAIN
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.676314

Item 381
International Polymer Science and Technology
24, No.11, 1997, p.T/1-7
RADIATION CROSSLINKING OF TPE COMPONENTS IMPROVES PRODUCT PROPERTIES
Zyball A
The use is discussed of radiation crosslinking to improve the properties of finished parts made from thermoplastic elastomers, in particular relating to the temperature range in which the parts are to be used. Since shaping is completely separate from the crosslinking itself, the two production stages can be optimised separately. Radiation crosslinking gives TPEs the properties of elastomers above the melting point of the hard segments, enabling parts made from radiation crosslinked TPEs to be used at high temperatures, with the material meeting the requirements of elastomers, whilst offering the processability of thermoplastics. 2 refs. (Full translation of GFK, No.9, 1997, p.702)
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.676313

Item 382
Parkersburg, W.V., 1996, pp.11, 11ins. 27/1/98.
ABS/CHLORINATED POLYETHYLENE BLENDS FOR THERMOPLASTIC ELASTOMER APPLICATIONS
Wypart R W; Avakian R W
GE Specialty Chemicals Inc.
A new patented technology from GE Specialty Chemicals allows the blending of ABS-based Blendex modifier resins with chlorinated PE to create a new spectrum of materials from soft and flexible to rigid, high impact materials. This paper compares physical properties and flow characteristics of ABS/CPE blends based on different CPEs (% chlorine and molecular weights), and different ABS modifiers (rubber types, particle sizes, and % rubber). Performance of these thermoplastic elastomers versus Santoprene TPE are investigated. 8 refs.
KRATON POLYMERS FOR ADHESIVES AND SEALANTS
Shell Chemical Co.

Detailed technical product details are presented for Kraton thermoplastic elastomers for use in adhesives and sealants, from Shell Chemical Co. Their structure, characteristics, properties and benefits are described, and formulation information is given with reference to the effects of fillers and plasticisers on adhesive properties. Melt processing and solution processing are also discussed.

USA
Accession no.671910

Item 383
Houston, Tx., 1997, pp.47. 11 ins. 2/3/98.

PHASE STRUCTURE AND PROPERTIES OF SOME THERMOPLASTIC POLYESTERAMIDE ELASTOMERS
Han Mo Jeong; Soon Won Moon; Jae Youg Jho; Tae Oan Ahn
Ulsan,University; Seoul,National University

Thermoplastic polyesteramide elastomers were synthesised by polycondensation of 4,4'-methylene diphenyl diisocyanate, carboxylic acid-terminated poly(butylene adipate) oligomers and three different aliphatic dicarboxylic acids. Mixing between the hard and soft phases depended on the contents and the molecular weights of the poly(butylene adipate) oligomers and on the types of the aliphatic dicarboxylic acids. Dissolution of the hard polyamide segment into the soft polyester domains increased with decreasing molecular weights of the constituent segments. The mixing was more effective when adipic acid, 1,10-decanedicarboxylic acid and azelaic acid (in increasing order of effectiveness) were used. A high degree of phase mixing enhanced the moduli but impaired the tensile properties at high deformation.

25 refs.
KOREA
Accession no.671897

Item 384
Polymer

CONTRASTS IN TPE COMPOUNDING
White L

European thermoplastic elastomer compounders are discussed, with respect to the differences between some major companies in the field. Particular details are given of the operations of API SpA, Evode Plastics Ltd., Softer SpA, Silac Chaignaud, Kraiburg, and Thermoplastiques Cousin Tessier. Company details including capacities are given for these and other compounders, and end-use sectors served by them are indicated.

VITA THERMOPLASTIC POLYMERS; APPLICAZIONI PLASTICHE INDUSTRIALI SPA; MULTIBASE SA; FRANCESCHETTI ELASTOMERI; SOFTER SPA; GUMMIWERK KRAIBURG GMBH & CO.; SILAC CHAIGNAUD; THERMOPLASTICHES COUSIN TESSIER; EVODE PLASTICS LTD.
EUROPE-GENERAL
Accession no.658409

Item 385
Geneva, 1997, pp.16. 30 cms. 17/10/97

PREPARATION OF THERMOPLASTIC ELASTOMERS BASED ON POLYBUTADIENE/POLYPROPYLENE DYNAMIC VULCANISATION ALLOYS AND STUDY OF PROPERTIES
Jalali G; Khalkhaly T; Katbab A A; Nazokdast H
Kerman Tire & Rubber Co.; Tehran,N.I.O.C.Res.Inst.of Petroleum Industry; Amirkabir,University of Technology (Rubber Research Institute of Malaysia)

The morphological, rheological, physicomechanical and dynamical properties of thermoplastic elastomers from PP-polybutadiene rubber dynamic vulcanisation blends are studied with regard to effect of blend ratio and curing agent amount used for vulcanisation of elastomer phase, and the results are compared with the simple mixing method. The effect of carbon black and oil are also studied. Effect of curing system type using three systems (sulphur, peroxide, phenolic resin) are examined. Morphological
studies by SEM and dynamic mechanical analysis show that blending systems are two-phase systems that, in the case of simple blends, both form continuous phases, while in the case of DVAs the rubber phase remains as dispersed particles in the PP matrix. Physicomechanical studies show that in all cases properties improve by dynamic vulcanisation in comparison with simple mixing. In DVAs, ultimate tensile strength, elongation at break, stress at 100% strain and hardness increase with increase in amount of curing agent. 19 refs.

HYTREL AND ZYTEL PROTECT LONGEST FIBRE-OPTIC LINK

Down-the-wire communications around the globe, such as data transmissions as well as telephone and fax links, should work faster and better after the end of 1997, when the world’s longest undersea fibre optic cable system is due to come into service. The cable, known under the acronym of FLAG (Fibre-optic Link Around the Globe), runs along the sea bed from Britain to Japan. Its route from Britain takes it out into the Atlantic Ocean, south around Spain and into the Mediterranean; on through the Suez Canal into the Red Sea, thence across the Indian Ocean and into the Pacific Ocean, where it turns northwards to arrive in Japan. It links up with existing cables at 13 landing points in Europe, the Middle East and Southern Asia along its total length of nearly 27,000 km. About 15,000 km of the FLAG cable, or more than half its total length, was manufactured by Simplex Technologies, of Portsmouth, New Hampshire, USA. Simplex used Hytrel engineering thermoplastic elastomer and Zytel nylon resin to protect the cable’s delicate optical fibres against mechanical damage during handling and installation. Simplex Technologies, a subsidiary of Tyco International, completed production of the 15,000 km of cable for the FLAG system in February 1997. The cable is being laid by AT&T Submarine Systems. Details are given.

METALLOCENE POES BOUNCE OTHER RESINS FROM A VARIETY OF ELASTOMER USES

Sherman L M

Metallocene-catalysed polyolefin elastomers from DuPont Dow Elastomers are low density copolymers of ethylene and octene, which are growing in use as substitutes for EPDM, flexible PVC and EVA, and other olefinic thermoplastic vulcanisates. These materials were originally used as impact modifiers for thermoplastic olefins, but are now reported to be gaining ground as the sole resin or major component of extruded and moulded products. An overview is presented of their use as replacement materials in end-use applications such as wire and cable, footwear, soft-touch applications, automotive applications and appliances.

REFERENCES AND ABSTRACTS

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normal methods used in plastics processing - injection moulding, extrusion, compressed air moulding, etc. Features of the behaviour of TPEs are due to the formation of a specific structure when the rubber and the thermoplastic material are combined. TPEs are two-phase systems, and here particles of crosslinked rubber of \(0.5-10\) \(\text{m}\) size are distributed in the continuous phase of thermoplastic material. Interaction between the phases occurs through physical bonds with the formation of a developed boundary layer. The properties of TPEs during processing and service are connected with features of boundary layer formation and rearrangement. During the service of TPEs, especially at increased temperatures, the likelihood of reduction in physical interaction, phase separation, and consequently deterioration in the properties of these materials is high. Therefore, to develop the most effective compositions and materials based on them, it is necessary to know the laws governing the change in structure and properties during long-term heat ageing at different temperatures. The laws governing the change in properties and structure of thermoplastic elastomers during ageing at 70-150 \(\text{deg.C}\) in the free and the stress state are investigated. 10 refs.

**RUSSIA**

Accession no.647839

**Item 392**


**FOAM EXTRUSION OF THERMOPLASTIC ELASTOMERS USING CO2 AS BLOWING AGENT**

Kropp D; Michaeli W; Herrmann T; Schroeder O
IKV (SPE)

An experimental investigation is conducted to research the foamability of different thermoplastic elastomers (TPE) using CO\(_2\) as blowing agent and Hydrocerol as nucleating agent. For each material, different foaming temperatures as well as blowing and nucleating agent percentages are examined. A specific TPU-type shows the best foamability; an SEBS-type is also successfully foamed and a PP/EPDM-blend especially developed for foaming with water is the most difficult to foam with CO\(_2\) as blowing agent. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.639904

**Item 395**


**STUDY FOR DYNAMIC VISCOELASTIC PROPERTIES OF POLYSTYRENE THERMOPLASTIC VULCANISATE**

Mori R; Sato R; Tasaka M
Riken Vinyl Industry Co.Ltd. (SPE)

The dynamic viscoelasticity of a TPV with a PP matrix structure and a dispersed PE/PS block copolymer based crosslinked rubbery phase by dynamic vulcanisation processing is reported. There are three peaks occurring in the region of 70, 110 and 140 \(\text{deg.C}\), respectively in dynamic viscoelastic spectra of the materials. The first and third peaks are thought to result from PE, which become weakened for crosslinking of free molecular Thermoplastic elastomers (TPES) are finding increasing uses in the packaging of pharmaceutical applications. The requirements for cleanliness, functionality and biocompatibility are expanding due to the escalating introduction of biotechnology drugs. Furthermore, the ability of TPEs to be insert moulded with polyolefins offers unique design and packaging opportunities that provide the cleanliness and compatibility necessary for filling operations such as blow-fill-seal. Some of the chemical requirements that are necessary to meet various national pharmacopoeias for closure applications are discussed. In addition, basic functionality requirements of pharmaceutical closures are reviewed and examples of some injection moulded and insert moulded products are shown. 4 refs.

USA

Accession no.639906

**Item 394**


**MELT RHEOLOGY OF DYNAMICALLY VULCANISED RUBBER/PLASTIC BLENDS**

Chung O; Coran A Y; White J L
Akron, University (SPE)

The effect of dynamic vulcanisation on the viscoelastic properties of EPDM/PP and NBR/PP blend systems is investigated. Experimental studies show that TPV melts behave similarly to filled polymer melts. They form a three-dimensional network structure at low shear rate. Dynamic vulcanisation significantly increases the viscosity of the blends. Polarity difference between rubber and plastic, oil extension and vulcanisation system changes have a significant effect on the flowability of TPVS. 15 refs.

USA

Accession no.639907

**Item 393**


**PARENTERAL PACKAGING APPLICATIONS FOR THERMOPLASTIC ELASTOMERS**

Young S
West Co.Inc. (SPE)
chains of PE. The second peak is assigned to the microbrownian segmental motions associated with Tg of PS which are influenced by crosslinking of PE. 18 refs.

**JAPAN**

*Accession no.639903*

**Item 396**

**TAPPI 1996 Hot Melt Symposium. Conference proceedings.**

Phoenix, Az., 16th-19th June 1996, p.71-98. 6A1

**AChieving High Service Temperatures with Thermoplastic Elastomers**

Himes G R; Hansen D R; Fulton S L; Shafer D L

Shell Development Co.

(TAPPI)

This paper discusses in some detail the blending of newly developed grades of polyphenylene ether with thermoplastic elastomers in order to achieve high service temperatures for adhesives and sealants. The incorporation of a new low molecular weight endblock reinforcing resin with modified flow properties which is also said to improve the service temperature of the thermoplastic elastomer is also discussed. 13 refs.

**USA**

*Accession no.638951*

**Item 397**

**Plastics World**

54, No.3, March 1996, p.16-20

**TPE Condom Sets New Technology Standard**

Schut J H

Ortho-McNeil has developed the world’s first thermoformed male condom. The company’s patent covers method, product and use of a series of linear block copolymer polyester urethanes to make condoms and other similarly shaped products. The patent describes the possibility of up to a 20:1 draw ratio, with 10:1 optimal for the condom, and wall thicknesses of 0.005-0.25mm, with 0.01-0.10mm optimal. The patent describes several ways to control the flowing preform during plug-assisted drawing and forming.

**ORTHO-MCNEIL INC.**

**USA**

*Accession no.637579*

**Item 398**

151st ACS Rubber Division Meeting, Spring 1997, Conference Preprints.

Anaheim, Ca., 6th-9th May 1997, Paper 43, pp.7. 012

**Thermoplastic Rubber as a Shoe Soling**

Carter A R; Turner R H

SATRA Footwear Technology Centre

(ACS,Rubber Div.)

Applications of styrene-butadiene-styrene block copolymer thermoplastic elastomers in shoe soles are examined. Injection moulding conditions and compounding techniques aimed at optimising properties are discussed, and methods for measuring wear resistance, coefficient of friction and flex cracking resistance are described. A surface chlorination process developed by SATRA to promote bonding with PU adhesives is also outlined. 1 ref.

**EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA; WESTERN EUROPE**

*Accession no.636051*

**Item 399**

**Kautschuk und Gummi Kunststoffe**

50, No.4, April 1997, p.292-8

**Therm-Oxidative Ageing of Polyvinyl Chloride-Based Thermoplastic Elastomers**

Ishiaku U S; Shaharum A; Ishak A Z M; Ismail H

PVC and ENRN based thermoplastic elastomers (TPEs) were prepared in the mixing chamber of a Brabender Plasticorder. ENRN is the ENR produced after the major modification of the ‘Old’ ENR (ENRO) production process. Unaged and aged blends were characterised by means of FTIR, tensile properties, tear strength, hardness and dynamic mechanical analysis (DMA) and compared with those of the ENRO. The improvement in all properties suggest that the ENRN can be used to make stable TPEs which are much less sensitive to thermo-oxidative ageing and other agents of degradation at ambient conditions. DMA-studies gave a single Tg reaffirming the earlier studies of miscibility. The decrease in Tg with increased plasticiser concentration is an indication of the effectiveness of DOP while the increase in tan 6 maximum signify increased damping. 22 refs.

**MALAYSIA**

*Accession no.635690*

**Item 400**

**Polymer Testing**

16, No.2, 1997, p.133-45

**Comparison of the Weather Resistance of Different Thermoplastic Elastomers**

Lonnberg V; Starck P

Helsinki, University of Technology

The weather resistance of different thermoplastic elastomer blends was compared by measuring changes in hardness, tensile modulus, tensile strength and elongation at break. The hardness and tensile modulus of all polymers increased to some extent during the exposure period. Dynamic mechanical properties such as storage modulus, loss modulus and damping properties were studied over a wide range of temperatures. 10 refs.

**FINLAND; SCANDINAVIA; WESTERN EUROPE**

*Accession no.634095*
References and Abstracts

Item 401

Polymer Degradation and Stability
56, No.1, 1997, p.115-21

ANALYSIS OF WEATHERING OF THERMOPLASTIC POLYESTER ELASTOMERS. I. POLYETHER-POLYESTER ELASTOMERS
Nagai Y; Ogawa T; Liu Yu Zhen; Nishimoto Y; Ohishi F
Kanagawa,University; Qingdao,Institute of Chemical Technology

The weathering of thermoplastic polyester elastomers was studied by GPC, thermogravimetry/differential thermal analysis, FTIR and hydrogen ion NMR and other methods. Outdoor exposure tests and accelerated weathering test with Sunshine Weather-meter were carried out. 4 refs.

China; Japan
Accession no.632443

Item 402

Plastics World

WHAT YOU SHOULD KNOW ABOUT PROCESSING SBCS
Kutka J
GLS Corp.

The most widely used thermoplastic elastomers are styrenic block copolymers. SBCs offer unmatched versatility and are among the easiest compounds to process. SBCs are easily coloured and do not require drying prior to processing. The materials are especially suitable for extrusion. Processing guidelines, including typical screw configuration, are presented. A problem solving table is also given.

USA
Accession no.628623

Item 403

Popular Plastics and Packaging
41, No.11, Nov.1996, p.55/8

NEW TECHNOLOGY FROM ADVANCED ELASTOMER SYSTEMS SPURS OPPORTUNITIES FOR TPE

Advanced Elastomer Systems has developed the industry’s first fully vulcanised, non-hygroscopic thermoplastic elastomer. It will initially be available in easy-to-colour, high-flow injection moulding, extrusion and FDA grades. Santoprene 8000 provides good compression set, tensile strength and heat ageing. In addition, it does not require predrying and have very low extractables.

Advanced Elastomer Systems LP
USA
Accession no.624558

Item 404

European Plastics News
24, No.3, March 1997, p.19

ELASTOMERS BOND TO NYLON

Advanced Elastomer Systems has developed a new grade of its thermoplastic elastomer, Santoprene, that bonds when hot to polyamide and polyamides blends without needing primers or adhesives. The new grade will enable the development of components with a high performance elastomer bonded to polyamide that has superior impact strength, temperature and abrasion resistance than PP. One of the first commercial applications of the new technology is in the grips of power tools made by Black & Decker.

Advanced Elastomer Systems LP
USA
Accession no.624471

Item 405

Injection Molding
4, No.12, Dec.1996, p.36-7

FLOW RATES: COMPARING ELASTOMERS TO PLASTICS
Maniscalco M

To take full advantage of the materials specified before designs are finalised, it is necessary to know as much as possible about how each one behaves. Materials suppliers’ data sheets may provide insight on mechanical, thermal, and electrical properties. Filling simulations may also be conducted. To do this, it is essential to know a resin’s melt viscosity to determine if the molten polymer can flow fast enough from the gate to fill a certain length within a part design. As these flow lengths get longer, for example, materials must have lower viscosity to avoid freezing off too soon. While tests for melt flow are fairly well known in the plastics field, the tests for elastomers are another matter. As more applications turn toward over moulding thermoplastic elastomers for touch, aesthetics, and impact protection, designers need to realise that their is no comparison. Details are given.

Advanced Elastomer Systems LP
USA
Accession no.618635
References and Abstracts

Item 407
Plastics World
54, No.11, Nov.1996, p.77
THERMOPLASTIC ELASTOMERS
Thanks to new polymerisation, alloying and catalyst technologies, today’s thermoplastic elastomers can provide cost and performance advantages over such long-time competitors as thermoset rubber, PVC and some flexible grades of theroplastic. The major groups of TPEs include thermoplastic urethanes, styrenic block copolymers, olefins and copolysters. The properties and applications of these TPEs are outlined.
USA
Accession no.614646

Item 408
Rubber Chemistry and Technology
DYNAMICALLY VULCANISED THERMOPLASTIC ELASTOMERS
Abdou-Sabet S; Puydak R C; Rader C P
Advanced Elastomer Systems
A review is presented of the literature on dynamically vulcanised thermoplastic elastomers. Aspects covered include thermoplastic vulcanisates (TPVs) versus simple blends, dynamic vulcanisation, compatibility (morphology), properties, types of TPVs (non-polar elastomer/thermoplastic resin systems including EPDM-based TPVs, butyl rubber-based TPVs, NR-based TPVs, multi-elastomer TPVs and alternative thermoplastic phase resins), processing of TPVs and applications of TPVs. 64 refs.
USA
Accession no.610695

Item 409
Manchester, 17th-21st June 1996, poster 4. 012
STUDY OF BLENDING AND MODIFICATION OF TPU/CPE
Yan Z X
Beijing, Research & Design Inst.of Rubber Ind. (Institute of Materials)
TPU is a relatively new class of material which combines the excellent strength of plastics and the elastic characteristics of rubbers. However, TPU is said to be one of the most difficult to process. Blending of TPU with other polymers to modify the processing characteristics and water absorption of TPU is now a commonly accepted method. The blends of TPU with various parts of chlorinated PE (CPE) by melt blending with two rolls are studied. The physical properties, such as mechanical, oil resistance and low temperature resistance of the blends have been measured and analysed. The results indicate the blends can obtain the good properties of high elongation of break, oil resistance and low temperature of pure TPU with less than 50% compositions of CPE but the tensile strength is slowly reduced as the compositions of CPE increase. The rheological properties of blends are also measured using a Koka Flow Tester. The results show that both pure TPU and TPU/CPE blends are pseudoplastic fluids, and the sensibility of apparent viscosity to temperature of polymers have been reduced with the addition of CPE. It is concluded that the processing characteristics of pure TPU can be significantly improved by the addition of CPE. 2 refs.
CHINA
Accession no.610148

Item 410
Manchester, 17th-21st June 1996, paper 13. 012
NOVEL LOW TEMPERATURE RESISTANT TPEs FOR SPECIALITY APPLICATIONS
Ellul M D
Advanced Elastomer Systems LP (Institute of Materials)
Thermoplastic elastomers (TPEs) with a broader service temperature range have long been desirable. An attempt is made to improve the low temperature resistance of thermoplastic elastomers without compromising performance at other temperatures. One predominant class of TPEs consists of dynamically vulcanised blends of elastomer with thermoplastic. Typical are heterophase TPEs comprising a PP matrix and dispersed micron sized domains of crosslinked elastomers such as EPDM, butyl and natural rubber. These TPEs can be deficient in low temperature performance due to the inherently brittle nature of PP at subzero deg.C and the crystallinity of certain elastomers. It has now been discovered that the low temperature toughness of heterophase TPEs can be greatly improved through simultaneous plasticisation of both the elastomer and PP phases. Through the incorporation of certain miscible ester plasticisers, the glass transition temperatures of both the PP and the elastomer phases can be greatly depressed resulting in a super-tough material at -40 deg.C and below. Since only the amorphous component of PP is plasticised, the crystalline fraction is not much affected and the upper service temperature range is maintained. The resulting TPEs have an excellent balance of engineering properties to 125 deg.C. 20 refs.
USA
Accession no.610029

Item 411
EXTRUSION OF TPE PROFILES USING WATER AS PHYSICAL BLOWING AGENT
Meyke J; Hunziker P
Extrusion and coextrusion processes and machinery are described for the continuous foaming of thermoplastic elastomers using water as the blowing agent. Applications of this technology in the manufacture of sealing profiles are examined, and technical and environmental advantages are reviewed.

ADVANCED ELASTOMER SYSTEMS LP
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE
Accession no.609340

**Item 412**
150th ACS Rubber Division Meeting. Fall 1996.
Conference Preprints.

**THERMOPLASTIC POLYURETHANES WITH ENHANCED ELASTOMERIC PERFORMANCE**
Day R; Kim K
Goodrich B.F.,Co.
(ACS,Rubber Div.)

The properties and processing of Estane 58238 and Estane 58661 thermoplastic polyester-urethanes (B.F. Goodrich) are examined. Their mechanical properties are compared with those of Estane 58630 polyether-urethane and other rubbers and thermoplastic elastomers. It is shown that the new thermoplastic PU grades have more rubber-like elastic properties whilst retaining high tensile strength and abrasion, cut and tear resistance.

USA
Accession no.609316

**Item 413**
150th ACS Rubber Division Meeting. Fall 1996.
Conference Preprints.
Louisville, Ky., 8th-11th Oct.1996, Paper 14, pp.27. 012

**NEW NON-HYGROSCOPIC, UV RESISTANT THERMOPLASTIC VULCANISATES FOR EXTRUSION**
Medsker R E; Hazelton D R; Gilbertson G W; Pfeiffer J E
Advanced Elastomer Systems LP
(ACS,Rubber Div.)

An examination is made of the properties of fully cured thermoplastic elastomers consisting of dynamically vulcanised alloys of EPDM and PP and formulated for use in extrusion applications. Data are presented to illustrate improvements in colourability, colour consistency, UV resistance, surface smoothness, die build-up, black speck contamination and moisture absorption compared with other fully cured thermoplastic vulcanisates. Other advantages examined include low corrosivity and coefficient of friction and resistance to contact staining against silicone rubbers and painted surfaces. 9 refs.

USA
Accession no.609315

**Item 414**
Antec '96. Volume II. Conference proceedings.
Indianapolis, 5th-10th May 1996, p.1970-4. 012

**INJECTION MOULDING OPTIMISATION PROCEDURES FOR POLYOLEFIN PLASTOMERS AND ELASTOMERS**
Hoenig S; Hoenig W; Parsely K
Dow Plastics
(SPE)

Polyolefin plastomers and elastomers for flexible durable goods are injection moulded substantially different than the flexible PVC (F-PVC) or styrene block copolymers (SBC) they replace. Certain conditions, such as cold moulds and fast injection, must be utilised to effectively produce parts. The optimised injection moulding conditions for polyolefin plastomers and elastomers, oil-modified polyolefin plastomers and elastomers, and oil- and filler-modified polyolefin plastomers and elastomers, were studied. The effects of eight injection moulding variables on the physical properties of these unique polymers are given. Using the optimised conditions outlined, a step change procedure was developed. This procedure allows for efficient switch over from F-PVC, SBC or other resins to the polyolefin plastomers and elastomers wherein optimum moulding conditions and optimum performance are readily achieved. 4 refs.

USA
Accession no.607214

**Item 415**
Polyolefins IX. Conference Proceedings.
Houston, Tx., 25th Feb-1st March,1995, p.471-86. 42C1

**STRUCTURE AND PROPERTIES OF POLYOLEFIN PLASTOMERS AND ELASTOMERS PRODUCED FROM THE SINGLE SITE, CONSTRAINED GEOMETRY CATALYST**
Chum P S; Kao C I; Knight G W
Dow Chemical Co.
(SPE,South Texas Section; SPE,Thermoplastic Materials & Foams Div.)

The structure-property relationships of ethylene-octene copolymers (polyolefin plastomers, POPs, and polyolefin elastomers, POEs) produced by single site constrained geometry catalyst technology were studied. The POPs and POEs produced in this way have a controlled level of long chain branching along the polymer backbone which allows for improved rheological properties and enhanced processability. The effect of the comonomer (octene) content in the copolymers on their mechanical properties and morphology is discussed. POPs (with less than 20 wt% octene) crystallise into a conventional lamellar morphology, but POEs (with greater than 20 wt% octene) show a unique “fringed micelle” crystalline morphology. Higher density POPs, (greater than 0.92 g/cc) with lamellar morphology, show well-defined yielding
behaviour but this behaviour is less well-defined as the polymer density approaches 0.87 g/cc (“fringed micelle” morphology). The elastic properties also improve significantly as the polymer density decreases. 12 refs.

USA
Accession no.576303

Item 416
THERMOPLASTIC ELASTOMERS - PROPERTIES AND APPLICATIONS
Brydson J A
Edited by: Dolbey R
(Rapra Technology Ltd.)
Rapra Review Report No. 81
The nature and general properties of thermoplastic elastomers is discussed, followed by specific properties of the various classes. These include block copolymers and blends, with the first category being further subdivided into styrene block copolymers and engineering thermoplastic elastomers such as copolysters, copolyamides, TPU's and polyetherimide-silicone diblocks. Applications for these materials are considered with reference to automotive, footwear, general mechanical goods, wire and cable covering and medical applications. 429 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.574762

Item 417
Macromolecular Symposia
Vol.89, Jan.1995, p.259-75
NEW POLYOLEFIN ELASTOMERS FROM METALLOCENES
Galimberti M; Martini E; Piemontesi F; Sartori F; Camurati I; Resconi L; Albizzati E
Himont Italia SpA
New polyolefin elastomers (EPM and EPDM), obtained from metallocene based catalytic systems, are presented. The potentialities of metallocenes for the preparation of polyolefin elastomers are discussed with reference to the traditional vanadium and titanium based catalysts. The role played by a Ziegler-Natta catalyst, either stereospecific or aspecific, is discussed. Data are shown for catalytic activity, copolymer composition, sequence distribution, molecular weight, MWD, melting point, enthalpy of fusion, intrinsic viscosity, hardness, tensile stress at break, EB, hysteresis and elastic energy/total energy. 64 refs. (Presented at STEPOL’94, Int. Symp. on Synthetic, Structural and Industrial Aspects of Stereospecific Polymerisation, Milan, Italy, 6th-10th June 1994).
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.547216

Item 418
Fall Meeting(134th),1988.
Cincinnati,Oh.,18-21st Oct.1988,Paper 55,pp.28. 012
THERMOPLASTIC ELASTOMERS FROM NBR AND PVC
Stockdale M K
GOODYEAR TIRE & RUBBER CO.
(ACS,Rubber Div.)
The results are reported of a study of the influence of acrylonitrile level on NBR/PVC alloys along with a comparison of these NBRs with a crosslinked NBR designed specifically for PVC modification. Also examined are (1) the effects on these alloys of the molec.wt. of the PVC used; (2) the high plasticiser levels that can be used with these alloys and their impact on physical properties; (3) plasticiser type and effect on low temperature properties; (4) effect of antioxidants on heat ageing of NBR/PVC alloys; and (5) a comparison of typical NBR/PVC alloys versus other thermoplastic elastomers and conventionally cured NBR and EPDM. 10 refs.
USA
Accession no.389082

Item 419
ACS,Rubber Div. 120th Meeting - Fall
PREPRINT. 012
RUBBER - THERMOPLASTIC COMPOSITIONS.
V. SELECTING POLYMERS FOR THERMOPLASTIC VULCANISATES
Coran A Y; Patel R P; Williams D
An analysis relating mechanical properties to the characteristics of the pure rubber and plastics components was made of approximately 100 thermoplastic vulcanisate compositions based on 9 kinds of thermoplastic resin and 11 kinds of rubber in order to select rubber-plastic combinations which would give thermoplastic vulcanisates of good mechanical integrity and elastic recovery. Characteristics used in the selection were estimated surface energy, crystallinity of the hard phase plastic and critical chain length of the rubber molecules for entanglement. 22 refs.
Accession no.205269
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