Polymeric materials for the anticorrosion protection of gas and oil pipelines

A. F. Voloshkin and I. M. Shologon

Improvement in the reliability and durability of pipelines that have already been laid in the Ukraine, and also of those under design and construction, is one of the most important scientific and technical tasks.

An effective direction in the solution of this problem is the creation and introduction into industry of systems of reliable polymeric anticorrosion coatings for the external and internal surfaces of linepipes. Leading companies in Germany, the USA, Japan, etc., are successfully using three-layer polymeric coating systems for the anticorrosion protection of the external surface of large-diameter pipes, which include an epoxy primer for spraying on of the prime coat, an adhesive, and an upper polyethylene layer.

There is a great demand for such pipes in Russia, Turkmenia, Uzbekistan, Iran, and other countries in which there are considerable energy sources.

It must be pointed out that the main responsibility for ensuring the combination of necessary anticorrosion properties and resistance to the action of stray currents lies with the prime layer, while the polyethylene part protects against mechanical damage during transportation and laying of the pipes.

With a reliable prime coating, and having chosen, depending on the service conditions, an adhesive and a polyethylene with the appropriate characteristics, it is possible to increase the service life of the pipeline by a factor of 2–3 and to reduce the likelihood of ecological disasters.

Thus, the leading foreign companies, using the same primer combined with high-density polyethylene, are supplying systems for service in regions with a high annual average temperature, and, conversely, in northern regions it is recommended that low-density polyethylene with high elasticity and increased deformation characteristics be used.

Taking into account the fact that the production of each of the components of the three-layer polymeric coating is specific and expensive abroad, the tendency has developed to cooperate regarding the materials for the three-layer coatings, i.e., with account taken of the type of business of a specific enterprise and the availability of the raw materials, it produces the primer or the polyethylene with the adhesive. Then, one of the suppliers takes on the necessary research to determine the compatibility of the primer, the adhesive, and the polyethylene and supply the complete system to the user.

In the CIS, only the Kazan’ “Orgsintez” Association is producing 153-10K cable polyethylene, which is used at the “Khartsyzsk Tube Works” Open Joint Stock Company (OJSC) for the application of three-layer coatings. However, by virtue of the fact that is is significantly inferior to foreign grades of polyethylene in terms of cold resistance and thermal stability, it is used for the protection of pipes used in zones with a moderate climate. The adhesives are not being produced in any of the countries indicated. As regards the primer, UkrGosNILplastmass developed, in rapid time and expressly for these purposes, the epoxy primer UP-1906 for application of the prime layer in the three-layer polymeric coating. Together with the “KhTZ” Open Joint Stock Company, a number of systems have been selected that use UP-1906 as the primer, several adhesives, for example, “Lukalen A-3120” of the German company BASF and “Borealis ME-0420” of the Finnish company Borealis, and high-density polyethylene of grades “Lupolen 2452D”, “Borealis HE-3450”, etc.

At the “Khartsyzsk Tube Works” OJSC, work has been carried out on the optimisation of technology for
applying three-layer coating systems to the external surface of large-diameter pipes using primer UP-1906. Tests on specimens cut out from pipes with a coating showed that, in terms of a number of properties (adhesion, water resistance, etc.), they are on a par with foreign analogues such as “Basepox” (Germany), “Parselak” (Japan), and “Scotchkout” (Canada), while in terms of cathodic separation they are superior to the latter.

At the UkrgosNIIplastmass Experimental Works, the production of the composite UP-1906 has been organised with a capacity of 400 t/year, which fully meets the demands of the Khartsyzsk Tube Works for this material. Using the primer UP-1906, over 200 000 t of pipes have been produced, which have been used in the laying of the Odessa–Brody oil pipeline and the Dzhankoi–Feodosiya–Izmail, Torzhok–western border of Belarus’, and other gas pipelines.

The leading foreign companies are producing linepipes not only with an external anticorrosion coating but also with an internal coating. Besides corrosion resistance, this results in an improvement in the economic indices through a reduction in the energy consumption on the conveyance of gas and oil owing to a reduction in the internal resistance of the pipes.

Together with the Khartsyzsk Tube Works, work is being carried out in this direction, as a result of which the epoxy composite UP-1918 has been developed for the application of a coating onto the internal surface of large-diameter pipes. An advantage of the developed composite in comparison with foreign analogues is the absence in its composition of volatile organic solvents that may pollute the environment. UkrgosNIIplastmass is able to supply this composite in a volume of up to 500 t/year.

(No date given)