THE NOVEL COATING TECHNIQUE TO INCREASE THE RESISTANCE OF CUTTING TOOLS AND LIFE OF EQUIPMENT PARTS

Vladislav Krasnopivtsev
Scientific advisor – PhD, Assist. Prof. Evgeniy Konoplyanchenko
Sumy National Agrarian University
(40021, Sumy, G. Kondratyev St. 160, Technical Services Department, (0542) 62-78-35)
E-mail: technology@i.ua

Advances in the electrospark deposition of coatings onto metallic surfaces are largely associated with extensive research efforts conducted to ascertain what effect the phase composition and structure of electrode materials have on the material mass transfer and coating properties. A spark discharge occurs in microscopic volumes and lasts 50–400 msec. These processes involve high energy fluxes, influencing the electrode (anode) erosion and transfer and the properties of coatings formed on the cathode. The study of these phenomena has underlain a series of materials science solutions related to the electrospark deposition of coatings with desired properties. The electrode materials are currently developed in several areas. One is to improve the composition and structure of hard metals (primarily those made of tungsten and titanium carbides) using complex metallic binders and ultrafine starting powder mixtures and employing advanced consolidation techniques. The other area is to produce electrode materials from metallic alloys and intermetallide-hardened materials. Refractory alloy systems are used as well. The layer-by-layer electrospark deposition of metals and refractory compounds or hard metals onto metallic surfaces is a very promising technique.

To increase the wear resistance of a copper electrode in welding of galvanized steel sheets, a three-layer (TiC–Ni)–Ni coating with a Ni sublayer was deposited onto the electrode;there is also experience in applying multilayer coatings onto titanium alloy VT3-1. Analysis of the microstructure and wear resistance of the alloys and kinetics of electrospark deposition using Ni–Cr–Al alloy electrodes has shown that the alloy from the ternary eutectic region (50.3 wt.% Ni, 40.2 Cr, and 9.5 wt.% Al) is the most effective for recovery of worn parts. The coatings produced with this alloy reach 1.0 mm in thickness. The wear resistance and service life of these coatings are much greater than those produced with standard hardmetal WC6.

The layer-by-layer electrospark deposition of Cu, In, Pb, Cd, and Sn metals and Ti, V, and W metals, as well as their carbides and alloys of WC type onto metallic surfaces (provided that required process parameters are observed) increases the quality of the surface layer (compared to the coating without a sublayer): it combines adequate strength, lower roughness and porosity, and greater integrity.

The experiments and actual experience show that the novel technique and new electrode materials can increase the resistance of cutting tools and service life of equipment parts by at least four times compared to uncoated ones and by two times compared to coated standard hardmetals of WC type.