Nanostructured surfaces

Wear resistance of the surface nanocrystalline structure under an action of aggressive medium

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Nowadays great interest of scientists is attracted to the nanocrystalline structures (NCS) with high service properties and developing technologies of its forming. The technology of mechanical-pulse treatment (MPT) for forming of surface NCS was developed in Karpenko Physico-Mechanical Institute. The grain size of created NCS on the surface is in a range of 18-40 nm. It was shown that such structures could protect untreated (matrix) material from an action of corrosive-hydrogen medium.

The influence of diethyleneglycol on wear resistance of the friction pair axis-barrel in the gear pumps was studied. The investigations were carried out according to the scheme ring-insert with specific pressure 2 MPa in diethyleneglycol medium. Diethyleneglycol decomposes into hydrogen, oxygen and carbon due to mechanical and thermal decomposition in the friction contact zone. Hydrogen, penetrating into the surface layers of the friction pair elements, stimulates hydrogen embrittlement. The material of the rings was 40Kh (0.4C-1Cr) steel in as-received state after MPT and the same steel after quenching and low-tempering. The materials of the inserts were bronze CuAl8Fe2Ni2 and high-strength cast iron VCh60.

It was shown, that the highest wear resistance posses the friction pair steel 40Kh with the surface NCS and cast iron VCh60. At the same time, wear resistance of the friction pair 40Kh with surface NCS – VCh60 is higher almost by one order compared with the wear resistance of the friction pair steel 40Kh after heat treatment – bronze. The main effect was reached due to surface NCS on the 40Kh steel, which significantly increases microhardness and reduces friction coefficient. The reducing of the friction coefficient increases wear resistance of the material and also decreases a temperature in the friction contact zone. It suppresses the decomposition of the environment and the process of hydrogen saturation is retarded.