UDC 620.1

FRICTION AND SURFACE PHENOMENA IN TRIBO-COUPLING

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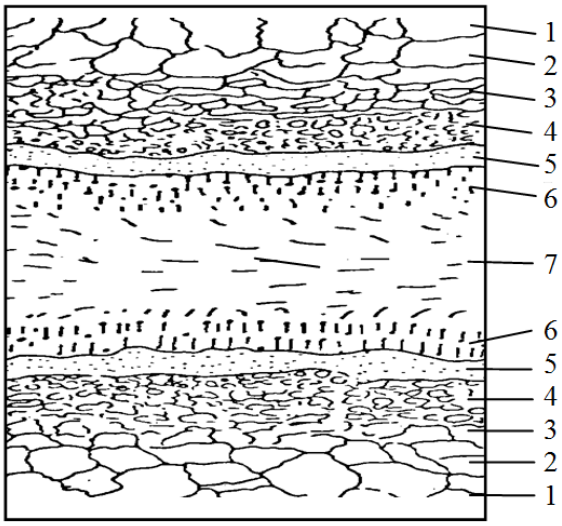
Expanding the scope of knowledge in the field of physics, chemistry and mechanics leads to an understanding of the complexity of the structure of the surface layer, which consists of a defective layer of solid material formed during its processing, oxide films, chemisorbed and adsorbed layers (Fig. 1).



1 – basic material; 2 – zone of elastic deformations; 3 – zone of plastic deformations; 4 – textured layer; 5 – a layer of oxides and surface compounds; 6 – boundary layer; 7 – hydrodynamic zone; 1–6 – in a solid body; 7 – in liquid

Fig. 1. Physico-chemical phenomena in triboconjugation

Joint consideration of molecular forces and deformability of the boundary layer led scientists to formulate the concept of the "third body" in contact, the boundary layer of the lubricating medium with adjacent films on solid contacting surfaces is considered as one of the main factors of interaction [1]. The emergence of highly effective physical methods (scanning electron microscopy, spectroscopy) of studying the structure and composition of the surface layers of solid bodies made it possible to obtain fundamental results that can be used to describe wear as a dynamic complex of processes of destruction of original structures, formation of new structures and their

destruction. This gave impetus to the creation of the theory of frictional interaction based on the description of mass transfer processes during friction. The structure of the transfer film is characterized by significant heterogeneity, a larger number of pores, which are micro reservoirs for the lubricant. Finely dispersed metal particles with an active surface serve as centers for the creation of polymer-like products. The presence of surface-active substances in the contact zone leads to a special frictional interaction characterized by a colloidal system of particles in the lubricant and structural transformations on the separation surface. This leads to the rapid adaptation of the friction pair and its transition to a stable mode of operation [2]. A change in the mode of friction or the properties of the surface layer significantly affects the amount of wear and the force of friction. During friction, the roughness of the boundary surfaces perceives both elastic and strong local plastic deformations with a disruption of the structure and the appearance of dislocations. As a result, the free surface energy increases and the contact zone receives a state of strong activation, which is accompanied by the emission of electrons, the transformation of substances, and the activation of chemical reactions. Modification of friction surfaces is a chemical saturation of surfaces in the process of friction itself. The process of selective transfer can be attributed to chemical modification. Chemical modification of friction surfaces depends on the presence of chemically active substances in the lubricant, which, interacting with metal surfaces, prevent adhesion and increased wear. The wear resistance of surfaces depends on the ratio of the rate of abrasion of modified layers and their formation in the friction process, the physical and chemical properties and dimensions of these layers (thickness and depth) [3].

Thus, by purposefully changing the external conditions, composition and nature of the lubrication, it is possible to change the properties of the friction surfaces in the desired direction.

References

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