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Success in synthesis of green triboengineering nanomaterials

Vladimir A Levchenko[1], **I A Buyanovskii**[2], **A N Bolshakov**[2] and **V A Matveenko**[1]
[1]Lomonosov Moscow State University, Russia
[2]Institute of Engineering Science, RAS, Russia

Our understanding of mechanism of lubricating action of boundary layers can be essentially extended on the base of multidisciplinary approach to the problem. Recently, the concept of "green tribology" regarding as "the science and technology of the tribological aspects of ecological balance and of environmental and biological impacts" was introduced. The field of green tribology includes tribological technology that mimics living nature (biomimetic surfaces) and thus is expected to be environmentally friendly, the control of friction and wear that is of importance for energy conservation and conversion, environmental aspects of lubrication and surface modification techniques, and tribological aspects of green applications such as wind-power turbines or another tribological devices. This paper is the first comprehensive volume on green tribology with using coating-orientants. In the presented paper, lubricating properties of boundary layers were considered from the position of tribology, nanotechnology and some concepts of physics and chemistry of liquid crystals.

Tribological properties of two new DLC—monocrystalline and amorphous nanostructural coating—are studied under conditions of boundary lubrication in inactive oil, as green tribology aspect. The friction tests were carried out by using two test configurations: "ball-on-disc" and "ring-to-ring". Friction surfaces were coated by carbon of two types: monocrystalline and amorphous ones. As lubricants some model and commercial oils were used. It is found that the friction coefficient and its temperature dependence differ significantly for carbon films under study.

The results of experiments have shown that the values of friction coefficient and the friction dependence via temperature are determined by the type of coating and its orientation properties. The difference in friction characteristics is connected with the different degree of orientation of molecules ELC in boundary lubricating layers on rubbing surfaces. Neither steel nor amorphous diamond-like coatings are not structural orientants. On the contrary carbon monocrystalline coatings increase the degree of molecular structural ordering in the boundary lubricating layers and consequently their lubricating ability. The monocrystalline coatings-orientants can improve lubricating properties of oils (with and without additives) and may be advantageous for engineering practice as they improve antifriction characteristics of rubbing pairs and allow controlling the processes of boundary lubrication. Thus, received DLC monocrystalline coatings-orientants can be today the best materials of green tribology.