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Synthesis and application of perspective nanomaterials in tribology

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The aim of this work was to find the fundamental possibility of synthesizing ceramics + monocrystal carbon (m-carbon) nanocomposite coatings using a system for the gas-phase synthesis of ceramics and the ion-plasma deposition of nanostructured carbon, which ensures the orienting effect in some base oils, as well as to assess the influence of these oils on the anti-friction behavior of this combined coating.

Thus, the fundamental possibility of producing the two-layer composite material has been established; the top layer of this coating is the layer of monocrystalline carbon, which ensures the formation of the highly ordered film of molecules of the lubricant with the homeotropical orientation at the interface with the lubricant that implements lubricating and protective effects under friction, and the bottom ceramic layer of the coating ensures the optimum stress-strain state of the friction contact. The antifriction characteristics of the composite coating were estimated using the reciprocal friction machine. It has been shown that the use of the composite coating makes it possible to improve the antifriction characteristics of two typical lubricating oils, i.e., mineral and synthetic, under boundary lubrication. However, these oils have different effects on the antifriction behavior of the composite coating. Under loads of 12.5 and 25 N, PAOM-4 oil ensures a higher decrease in the coefficient of the friction of the steel over the coating compared to the coefficient of the friction of the steel over the same steel than 1-20 oil does, while, under a load of 37.5 N, 1-20 oil ensures a substantially higher decrease in the coefficient of fric¬tion in transition from the steel—steel pair to the steel-coating pair. This is apparently explained by tribo-chemical processes, which are more efficient in 1-20 mineral oil than in more stable PAOM-4 synthetic oil. Recommendations about application of the received nanomaterials are provided in the conclusion of work.