Conclusions

The monograph covers results of investigation of triboengineering properties of LC-compounds and conceptual approach to explanation of their tribological efficiency at frictional interaction of different solids.

A wide range of information concerning the phenomena occurring between liquid crystals and other phases is presented. The lubricity of cholesteric-nematic LC-compounds is studied, their influence on tribophysical properties of natural of natural and artificial liquid mediums is determined; a link between parameters of LC-nanomaterials and technical features of metal- and biopolymer couples lubricated by them is established. A scientific concept of control of triboengineering parameters of natural and technical dissipative systems by means of implementing the ordered mesophase of boundary layers in dynamic contact area is proposed and discussed. Moreover, the medicines for the treatment of arthropathy, general in action mechanism and high-effective lubricants for machines and devices are created on the basis of the above concept.

New artificial lubricant mediums are developed on the bases of obtained experimental data. They contain cholesteric LC-nanomaterials inherent to natural synovia, possess its structural rheological and frictional characteristics and serve to both invasive and non-invasive application. The results of high chondroprotective efficiency of these preparations on osteoarthritis models and the benefits of clinical testing given in the book show that liquid crystals are of great importance for intra-articular friction reduction.

More detailed analysis of experimental data indicates that depending on their component structure, we can remark either mesophase range extension or temperature range increasing with minimal values of friction coefficient. Therefore, it is noted that in the circumstances the temperature resistance of boundary layers of cholesteric LC-mixtures exceeds the temperature resistance of lubricating layers with or without their mineral oils. Attention is drawn to the fact that the minimal values of friction coefficient for LC-compounds mixtures under consideration are observed in the temperature range including both mesophase area and a part of isotropic liquid. In other words, increasing friction coefficient in the process of tribosystem heating happens at temperatures when studied LC-nanomaterials have long been isotropic liquids. This ambiguous behavior of the LC-mixtures resulting

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in shift of temperature resistance of their boundary layers towards the temperature ranges relevant to the phase of isotropic liquid is caused by influence on LC-compounds of friction surfaces.

This is well evidenced by the fact that physical and mechanical properties of thin boundary layers of LC-compound molecules can change and differ from volumetric ones. In other words, decrease of friction coefficient observed for the cholesterol liquid-crystal nanomaterials above their elucidation points is of significant interest and not unexpected, as far as in this case boundary lubrication is defined by a mechanism where a lubricity efficiency is associated only with the properties of thin polymolecular films of LM which are border with solid surfaces.

The results presented in other works are also support this conclusion. According to them, there is a possibility that transition from ordered to disordered states of LC-films on the friction surfaces occurs at much higher temperatures then elucidation temperatures of their volume. As known, molecules of LC-nanomaterials can keep ordered (smectic, cholesteric etc.) structure until they reach this elucidations temperatures. It opens broad perspectives for using individual cholesterol liquid-crystal nanomaterials rather for their mixtures directly as lubricant materials with increased thermal resistance in relation to LM of different nature. As a result, a number of inventions related to new more effective liquid-crystal lubricant materials can be created on the basis of the finished research. Along with all these problems of tribology of liquid-crystal materials, there is a problem of their operational stability, what is meant both stability of the liquid crystals under conditions of the friction unit being in operating and stability over time of triboengineering parameters they provide. This problem solution is essential to the production on a large scale and application of tribotechnical liquid-crystal materials.

The studies in this area are currently under development and of great interest not only for professionals working in the field of liquid crystals but for tribologists and biophysicists. Such a situation in the lubricity research of cholesteric LC-nanomaterials makes the need for further in-depth works in this direction evident.

To sum up, it is hoped that the reported findings will attract the attention of tribology, arthrology and biophysics specialists and be used as background material to continue and intensify scientific work in research of unique triboengineering properties of liquid crystals, materials and preparations based on them.

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