Preface

The last decade is characterized by an increased interest in all industrialized countries to the problems of tribology, such as friction, lubrication, and wear. As a result of friction and wear, the surfaces of the solid frictional units undergo significant changes of their initial physical and mechanical properties. Therefore, the tribology of fracture faces a more challenging tasks than the usual problems of strength, it requires a consideration of wide range of factors, both in the study and the calculation of the processes of friction, wear, and lubrication, and in creating a reliable, durable economically and environmentally effective frictional units for machines, appliances, and apparatuses of technological processes.

The engineering science entered into the twenty-first century with a clear understanding of the importance of friction and need for its consideration in processes of development and design of various machine units.

In the first half of the twentieth century, the engineers approached friction with certain pragmatism, reducing the problem mainly to determining the coefficients of friction for specific practical conditions. It can be said that the theory of friction did not play any significant role for a long period of time. The second half of the twentieth century can be deservedly called the golden age of the tribological science; there was a significant interest to the theory of friction. The intensive development of nanotechnologies and the technologies of surface hardening, the emergence of new composites and nanomaterials could explain such interest to the theory of friction. Starting from the 1980s, a fundamentally new mathematical and physical methods were developed, which made possible to study the frictional contacts at the microscopic and atomic levels. Physical meso-mechanics, non-equilibrium thermodynamics, synergetics, fractals, nonlinear dynamics, and others—it is not even a complete list of new horizons in tribology. An integrated approach in finding correlations between tribological and strength properties of materials and their characteristics of the interatomic interaction can be the basis for an adequate description of the contact mechanism and also a prediction of tribological properties.

The development of mentioned scientific fields and their practical implementation will expand the application area of human intelligence and energy. Specialists and engineers will be able to calculate, diagnose, predict, and select appropriate materials for frictional pairs, and also assign the optimal operation regime for tribocoupling.

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