

# Preface

The year 2016 has become a jubilee of tribology connected to presentation of Prof. Peter Jost report to the British government in 1966. In this report, Prof. Jost has placed emphasis on the economic importance of the problem of friction and proposed the formulation of the scientific concept as “tribology” (from the Greek word “tribos”—rubbing): the science and technology of interacting surfaces in relative motion and of related subjects and practices. It was a reflection of a new synthetic approach to the problem having millennial roots. Engineering solutions of friction and lubrication problems by the ancient civilizations have led to the appearance of ski and wheel. Creation of the first lubricants based on vegetable and animal products have made possible the technological progress of the mankind.

Nowadays, friction is responsible for crucial problem of engineering—wear of machines and mechanisms. The expenses due to rehabilitation of the worn-out machine parts are enormous, whereas increase of their lifetime is very profitable. Drop of the losses on friction and energy saving, wear reduction in machines and mechanisms together with economy in materials, elimination of harmful ejections, and other topics are now a part of the tribology subject. In Jost’s opinion, in the course of its half-centennial development, the notion of tribology has penetrated into all the fields of human activities and natural phenomena connected with friction processes.

Modern tribology can be divided into the main areas specified as: fundamentals—contact mechanics, surface physics, and chemistry; materials science—development of materials, coatings, and lubricants for tribosystems; technologies—surface engineering; design—development of the efficient tribosystems; tribodiagnostics—methods and devices for condition and wear monitoring; testing, data processing and presentation in the form of standards, recommendations, as well as distribution of tribology achievements to research and engineering community.

This book covers the area of tribodiagnostics which is still not extensively presented in the technical literature. Its main emphasis is done to the problems of monitoring the lubricant, as it is an essential component of a tribosystem. During operation, the tribosystem is exposed continuously to the environment, elevated temperatures, speeds, and loads inducing variations of the chemical and physical

properties of the lubricating oil. The main causes of impairment of oil properties are modification of the oil chemical structure (oxidation, thermal destruction, decomposition of additives), higher content of water, and chemical impurities in the oil. Lubricating oil condition reflects the processes evolving in the tribosystem as a whole. On-line and in-line oil analysis systems provide timely data on the need for routine service or early warning of oncoming catastrophic events. The authors have presented an extensive review of the analytical methods, calculations related to the physics of the techniques used in their research, as well as the principles and designs of the monitoring devices, including their own ones.

The content of the book includes the introduction, six chapters covering the main aspects of the lubricating oil monitoring, and concluding remarks. The introduction positions the place of condition monitoring and predictive maintenance in the whole subject of tribology. First four chapters are related to the methods and tools for evaluation of oil physicochemical properties, as well as very important problems of monitoring the oil viscosity, water content, and soot concentration in oil. Fifth and sixth chapters cover the wear prediction for tribosystems based on debris analysis and trends in condition monitoring for tribology. Conclusions formulate the prospects of development of condition monitoring, as well as the main problems arising on this way.

The whole multidisciplinary subject of tribology is widening quickly and covers new areas of human activities. Nowadays, it is a great area of research and development having key validity for engineering in industry, transportation, agriculture, and even medicine. Condition and wear monitoring is an important part of tribology, so the authors hope that the current book can be useful for researchers and engineers working in such an important and useful area.

The personal experience of the authors is mainly connected to their work in the Metal-Polymer Research Institute of the Belarus National Academy of Sciences, as well as to the international cooperation started as early as 1980s with the Swansea Tribology Center in Great Britain, then continued with the Korea Institute of Science and Technology, and Austrian Center for Competence in Tribology. The authors are very much grateful to their colleagues in cooperation, especially to Prof. O.K. Kwon, Dr. Hosung Kong, Dr. H.-G. Han, and Dr. E.-S. Yoon (KIST). Their sincere thanks should be given to all the colleagues in MPRI, especially to M.S. Semenyuk and V.M. Makarenko.

Gomel, Belarus  
Minsk, Belarus

Nikolai K. Myshkin  
Liubou V. Markova

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Myshkin, N.K.; Markova, L.V.

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