



Book Reviews

Tribology of Plastic Materials, by Yukisaburo Yamaguchi, Vol. 16, Elsevier, 1990.

REVIEWED BY F. E. KENNEDY¹ AND T. A. BLANCHET¹

This book on polymer tribology is Volume 16 in the Tribology Series published by Elsevier. It is, for the most part, a translation of the book *Lubricity of Plastic Materials* written in Japanese by the same author in 1981. It consists of four chapters, each of which includes a considerable amount of experimental data from the author's laboratory at Kogakuin University in Tokyo.

The first two chapters, one dealing with friction and the other with wear, present theories of tribological behavior and discuss the experimental evidence upon which the theories are based. There is substantial discussion of the role of internal structure on polymer friction (but not the role of structure on wear). Chapter 3 deals with the self-lubricating properties of polymers and composites. It presents a good discussion of the improvement of those properties through polymer blending or the addition of fillers to polymer composites. Chapter 4, the longest chapter, discusses the application of polymers in mechanical components, including dry and lubricated journal bearings, ball bearings, brake shoes, gears and packings. Most of the references, especially in Chapter 4, are to the Japanese literature, but few of the references date from post-1980.

The book presents a good description of test methods for polymer friction and wear, and includes many results of tests conducted in Japanese laboratories. Many of those results were previously available only in Japanese, so the book gives the American or European tribologist access to those results for the first time. It also provides a view of the field of polymer tribology from the Japanese perspective. These are the book's most significant contributions.

Although the book presents friction and wear data for a large number of polymers and composites, and their potential use in a variety of applications, those data are not easy to find. The major reason for this is that the book lacks an index. This deficiency certainly decreases the value of the book as a reference. Even if it had an index, however, it would still be a bit difficult to put together a coherent story for a given polymer because of the way the book is organized. Chapter 3 is organized by material group, but the organization of chapters 1 and 2 is by phenomenon, with data for different materials being scattered throughout those chapters. Some of the figures, especially in chapters 1 and 2, are a bit confusing because of

the large number of materials and/or test variables included in the same plot.

This would be a useful addition to the bookshelf of a polymer tribologist or an engineer involved with the design of plastic mechanical components. It provides information on polymer friction and wear not otherwise available in any single source in English. It has less value as a reference for the general tribologist or engineer, however, primarily because of its lack of an index.

Mechanics of Coatings, D. Dowson, C. M. Taylor, and M. Godet (editors), Elsevier, Amsterdam, The Netherlands, 1990.

REVIEWED BY SAID JAHANMIR²

This book is the proceedings of the sixteenth Leeds-Lyon Symposium on Tribology held at the Institute National des Sciences Appliquées de Lyon from the 5th to the 8th of September 1989. Fifty-one papers covering contact mechanics, soft and viscoelastic coatings, solid lubricants, hard coatings, hardness of coatings, failure mechanisms, deformation and wear, biomechanics, and methods for coating evaluation. These papers represent an excellent overview of the theoretical and experimental methods for evaluating the behavior of coatings in tribological contacts. The book is divided into twenty sections, based on the conference sessions. The main drawback of the book is that some of the papers are not in the proper sections. This, however, is a minor inconvenience; anyone who has organized a major conference is well aware of this problem.

The invited papers in the first section cover a comprehensive review of the tribological behavior of lubricating oxide coatings, elastic properties of solid lubricant films, and elastic and viscoelastic analysis of coated surfaces in contact. The papers in the following two sections deal with the analysis of damage mechanism using the energy release rate, thermomechanical analysis of coatings subjected to high speed sliding contact, coating design methodology, reduction of friction coefficient in sliding ceramic and metallic surfaces by in-situ formation of solid lubricant coatings, and the effect of TiN coatings on rolling contact fatigue. The papers on solid lubricants discuss the effects of microstructure and adhesion of MoS₂ on performance, and the role of transfer films in wear of the coatings.

The relationship between the coating microstructure and tribological behavior of PVD coatings, phosphate coatings, TiN, CVD diamond films, N ion-implantation, and oxide films

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are presented in several papers. One paper presents results of a round robin coating evaluation program to determine the repeatability and precision of test data. Seven papers analyze the effect of coatings on contact stress, stress distribution in the coating and in the substrate, and propagation of cracks in the substrate as well as the interface between the coating and the substrate.

Several papers deal with experimental data, theoretical analysis, and deformation and fracture associated with indentation hardness and scratch testing on coatings. Two papers present an analytical method for the determination of the Young's modulus of elasticity for TiN and TiC coatings. Other papers deal with the detection of defects by acoustic microscopy and photothermal radiometry.