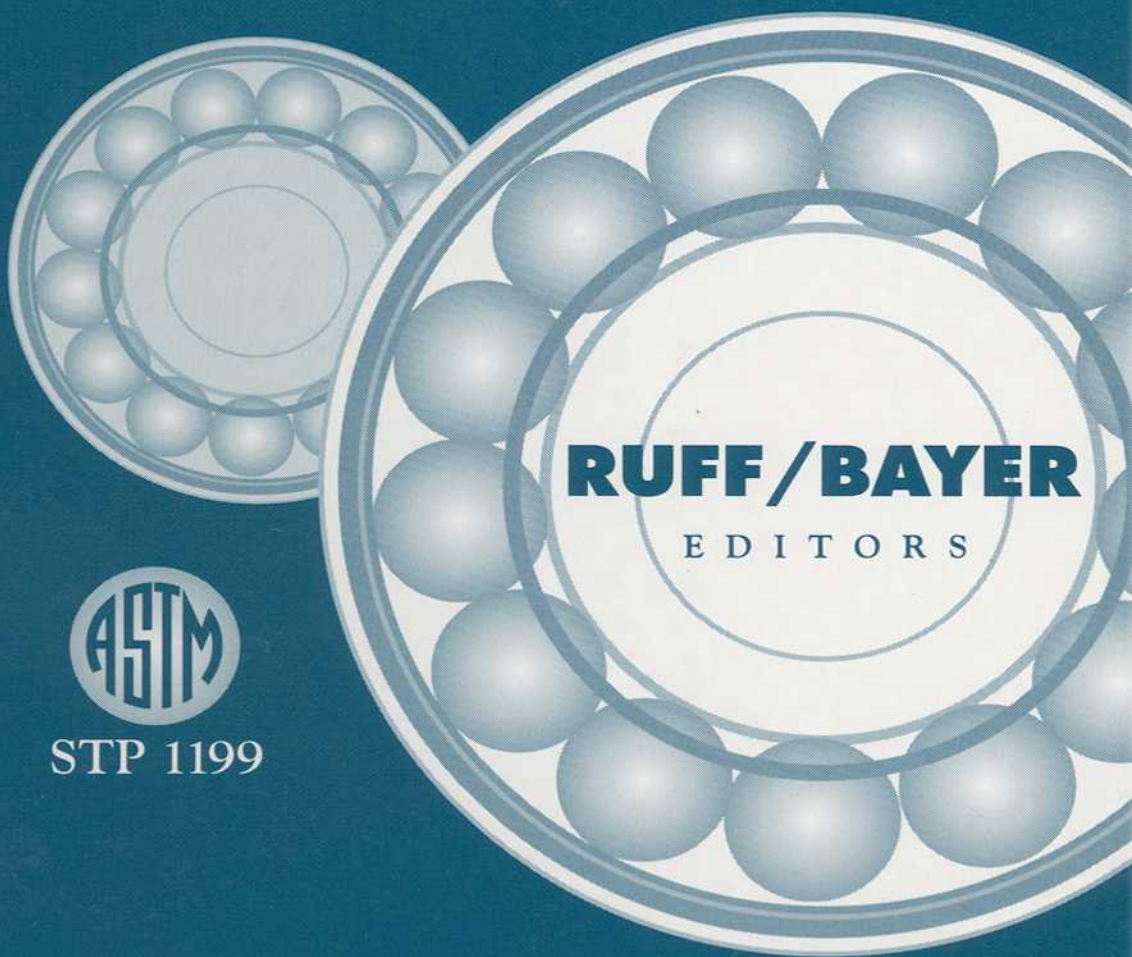


TRIBOLOGY

**WEAR TEST SELECTION FOR
DESIGN AND APPLICATION**



STP 1199

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Tribology: Wear Test Selection for Design and Application

A. W. Ruff and Raymond G. Bayer, Editors

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Peer Review Policy

Each paper published in this volume was evaluated by three peer reviewers. The authors addressed all of the reviewers' comments to the satisfaction of both the technical editor(s) and the ASTM Committee on Publications.

To make technical information available as quickly as possible, the peer-reviewed papers in this publication were printed "camera-ready" as submitted by the authors.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution to time and effort on behalf of ASTM.

Foreword

This publication, *Tribology: Wear Test Selection for Design and Application*, contains papers presented at the symposium of the same name, held in Miami, FL on 9 Dec. 1992. The symposium was sponsored by ASTM Committee G-2 on Wear and Erosion. A. W. Ruff of the National Institute for Standards and Technology (NIST) in Gaithersburg, MD and Raymond G. Bayer, a Consultant in Vestal, NY, presided as symposium chairmen and are editors of the resulting publication.

Contents

Overview—A. W. RUFF AND R. G. BAYER	vii
Development of a Wear Test for Adiabatic Diesel Ring and Liner Materials—W. A. GLAESER AND P. A. GAYDOS	1
Friction Characteristics of Plastic Plain Bearings at Low Velocity—K. G. BUDINSKI	17
Laboratory and Robot Wear Test Selection for Computer Peripherals—R. G. BAYER	31
Realizing Bench Test Solutions to Field Tribology Problems by Utilizing Tribological Aspect Numbers—R. M. VOITIK	45
Extreme Pressure and Anti-Wear Properties of Lubricants: A Critical Study of Current Test Methods and Suggestions for the Future—M. A. PLINT AND A. F. ALLISTON-GREINER	60
Comparison of Laboratory Abrasion Tests and Field Tests of Materials Used in Tillage Equipment—P. A. SWANSON	80
The Miller Number—A Review—J. E. MILLER AND J. D. MILLER	100
Test Method and Applications for Slurry Erosion—A Review—H. McI. CLARK	113
A Retrospective Survey of the Use of Laboratory Tests to Simulate Internal Combustion Engine Materials Tribology Problems—P. J. BLAU	133
Laboratory Wear Tests for Qualifying Automotive Air-Conditioning Lubricants for Use with Refrigerant HFC-134a—S. I. TSEREGOUNIS, J. A. SPEAROT, F. G. ROUNDS, J. A. BAKER, AND B. C. SERRIANNE	149
Friction and Wear Set-Up for Simulation of Knee Joint—S. BAHADUR	173
The Use of Surface-Layer Activation to Measure Ring Wear in an Operating Heavy Duty Diesel Engine—J. J. TRUHAN AND C. B. COVINGTON	177

Overview

ASTM's Committee on Wear and Erosion has sponsored numerous symposia in subject areas such as wear, solid particle erosion, cavitation, and wear modeling. The focus of those symposia and the resulting Special Technical Publications (STPs) involved numerous scientific and engineering subjects, as well as the matter of test methodology. One important area that has not been covered so far is the connection between laboratory testing and actual operating performance of systems or components. The connection between laboratory testing, test results, and final design and performance is a crucial one in the practical application of tribology science and engineering.

The very nature of wear makes this connection a complex one. It is well recognized that wear, as well as erosion and friction, is not intrinsic to any material or set of materials but depends on the application parameters, such as load, pressure, temperature, environment, and so forth, as well as the material properties. Knowledge of the functional dependencies of wear on such parameters is often qualitative, incomplete, and in some cases, not known at all. As a result, the validity or accuracy of any extrapolation of laboratory test results to specific applications is generally a major concern. In view of this, the Committee felt that it would be desirable to organize a symposium specifically focusing on the successful connection of laboratory test results and application performance. It was hoped that this would help to identify some methods for establishing or ensuring valid connections of this kind, or at least, would provide some guidance.

Since the problem of relating laboratory test results to application performance is primarily faced in industry, strong industrial participation in the symposium was necessary. While a wide cross section of U.S. industry is represented in the Committee, the call-for-papers was not limited to the Committee or to ASTM membership. As a result, 12 papers focusing on wear test selection for design and application were accepted and presented at the symposium, primarily from industry sources.

A common problem in addressing design and application issues concerning wear and erosion is the selection of one or more tests that will reliably rank or select materials among those of initial interest, and also provide some measure of relative performance of the materials in the application. As indicated in several prior STPs concerning the selection and use of tests for different categories of materials, simulation of the application is a key to the connection of test results with actual performance. Often standard wear tests, including the tests developed by the Committee, do not meet the requirements of simulative testing for an application. Simulation testing includes critical use conditions, such as contact pressure, contact geometry, and the specific environment, which generally are not duplicated in standard tests. Frequently it takes an expert in wear and erosion phenomena to correctly design or select the simulative test required.

Since such expertise may not be available in an organization, consultants are frequently called upon to develop such testing protocol. While this might seem a costly approach, the alternative to simulative testing is to use full-scale component or system testing, which is often too time consuming and expensive.

One of the aims of the symposium and this STP was to show by example how successful simulative testing has been accomplished. Specific examples are presented from a number of applications involving different forms of wear, including some from such specialized areas as computer peripherals, engines, and prosthetic devices. An important consideration in all the presentations was the identification of critical use conditions. It is hoped that by reading

the examples presented in the papers contained in this STP, readers can find guidance in addressing their individual wear problems.

The existence of this common theme in these papers suggests that it might be possible to develop a standard guide for the selection and development of simulative laboratory wear tests. Such a guide would likely comprise a check list of considerations, with appropriate weighing and priorities indicated. For example, the matter of contact area and pressure would be treated, with discussion on the sensitivity of some materials, for example, polymers, to small contact area or high pressure. Conformity of contact, that is, the closeness of the geometric shapes, would be another important area. It is hoped that such a document, developed using the broad range of experience in wear and erosion application encompassed in the Committee membership, would serve the technical community in this important area of design and application. It is anticipated that the Committee soon will initiate activity pursuant to the development of such a standard.

Finally, the chairmen of this symposium gratefully acknowledges the contribution of all the presenters and of the discussors during the meeting, as well as the contributions of the reviewers of the papers contained in the STP. It is hoped that all who participated gained a clearer view of the range of problems concerning end-use applications, and that the readers of these papers will find them beneficial in resolving their problems.

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