

**BOOK NOTES****Tribology of abrasive machining processes**

by Dr. Ioan Marinescu et al, 650 pages, © 2004 Noyes ISBN: 0-8155-1490-5  
Detailed TOC available online or via e-mail. \$160 plus shipping

---

While the purpose of this book is to introduce the tribology of abrasives, it is one of a few that actually compiles what is known about grinding and other abrasive processes joining **Principles of Abrasive Processing** by Milton Shaw and **Grinding Technology** by Dr. Stephen Malkin as a major technology resource. Though the style and content is more for the researcher and scholar than the public, nearly everyone who is serious about grinding will find useful information in its contents. To produce this book, Dr. Ioan Marinescu, University of Toledo, headed a team international experts that gathered and updated information scattered among personal notes and hundreds of technical papers around the world. Brief biographies of the contributors are posted on the AES website.

At first glance, the connection between grinding and tribology seems contrived, particularly if tribology is understood as the traditional study of wear, friction and lubrication. But a more complete definition of tribology—the study of how surfaces interact—and contemporary machining trends show that the connection is indeed a good one. To Marinescu tribology is the right tool for studying the uses of abrasives and for understanding processes like chemical mechanical polishing (CMP) which bridge the disciplines of physics, chemistry, and mechanical engineering. Trends to develop processes concerned with nanometer-sized particles and surface features focus on the interaction between abrasive and workpiece surfaces and enter the realm of tribology. Unlike traditional empirical research, tribology emphasizes scientific fundamentals and mathematical analysis. The benefits reach all types of abrasive processes, not just applications in the electronics industry, and are well illustrated by new CNC controls and software that provides intelligent control of grinding hardware.

Aside from a discussion of tribology, the value of this book appears in it's treatment of subjects such as thermal aspects of grinding. Whole chapters are dedicated to discussions of what is thermal damage, how heat flows through the workpiece and how fluids affect the process. One section shows how chip size and shape can give clues to the thermal dynamics of a process. The evolution of contemporary theories appears in a table of milestones in research on energy and heat in grinding. Quotes from commentary that follows that table include: "Makino found that the actual length of the heat source was two to three times the geometric contact length." and "it appears that convective cooling in conventional grinding usually extracts less than 10% of the energy within the contact zone." In other sections the book explores process characteristics and energy flow. which show that contrary to traditional logic, "large depths of cut and high removal rates tend to be more efficient in energy terms than small depths of cut" and "reducing chip volume tends to increase specific energy."

Other sections of the book give good overviews of current practices, which could be a useful resource for training programs. The chapter on abrasives and abrasive tools, for example, is a nearly complete list of common natural and synthetic minerals used as abrasives and a list of related tradenames. The chapters on wheel conditioning examines all of the common methods to dress and true grinding wheels as well as best practices to extend dresser life. The chapter on ELID provides a good overview of this important technology.

The sections on use of metalworking fluids summarize information previously found only in books published by Marcel Dekker or SME. Unique in Marinescu's book are the discussions of fluid delivery systems and problems with the air boundary layer and fluid boiling point. The concise treatment of chemistry of formulations as well as the chemical interaction among fluids, workpiece and abrasives is also noteworthy. A chapter on simulation of molecular dynamics provides insight into cutting materials such as ceramics that are made up of small crystalline structures.

There are occasional distractions created by redundant text from multiple contributors or by awkward use of English. But the international authorship gives authority to the book and a perspective that avoids regional differences in technology such as preferences for water-based fluids in the US.

Useful tools scattered throughout this book include a glossary, a list of standardized symbols used in technical literature, and excellent bibliographies appended to each chapter. Though the emphasis is on grinding, most common process get fair treatment. Links to more details at [Mallinks](http://Mallinks.com).

**News Fax is a copyrighted publication** and is distributed only to subscribers and members of the Abrasive Engineering Society. Unauthorized copying and distribution is a violation of copyright.