

Osswald, Menges  
**Material Science of Polymers for Engineers**



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# Material Science of Polymers for Engineers

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# Preface to the First Edition

This book is designed to provide a polymer materials science background to engineering students and practicing engineers. It is written on an intermediate level for students, and as an introduction to polymer materials science for engineers. The book presents enough information that, in conjunction with a good design background, it will enable the engineer to design polymer components.

*Materials Science of Polymers for Engineers* is based on the German textbook, *Werkstoffkunde Kunststoffe* (G. Menges, Hanser Publishers, 1989), and on lecture notes from polymer materials science courses taught at the Technical University of Aachen, Germany, and at the University of Wisconsin-Madison.

The chapters on thermal and electrical properties are loose translations from *Werkstoffkunde Kunststoffe*, and many figures throughout the manuscript were taken from this book. We have chosen a unified approach and have divided the book into three major sections: Basic Principles, Influence of Processing on Properties, and Engineering Design Properties. This approach is often referred to as the four P's: polymer, processing, product and performance. The first section covers general topics such as historical background, basic material properties, molecular structure of polymers and thermal properties of polymers. The second section ties processing and design by discussing the effects of processing on properties of the final polymer component. Here, we introduce the reader to the rheology of polymer melts, mixing of polymer blends, development of anisotropy during processing and solidification processes. In essence, in this section we go from the melt (rheology) to the finished product (solidification). The third section covers the different properties that need to be considered when designing a polymer component, and analyzing its performance. These properties include mechanical properties, failure of polymers, electrical properties, optical properties, acoustic properties, and permeability of polymers. The authors cannot acknowledge everyone who helped in one way or another in the preparation of this manuscript. We would like to thank the students of our polymer materials science courses who in the past few years endured our experimenting and trying out of new ideas. The authors are grateful to the staff and faculty of the Mechanical Engineering Department at the University of Wisconsin-Madison, and the Institut für Kunststoffverarbeitung (IKV) at the Technical University of Aachen for their support while developing the courses which gave the base for this book. We

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