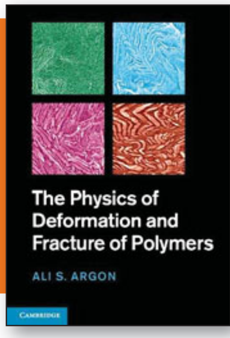


The Physics of Deformation and Fracture of Polymers

Ali S. Argon

Cambridge University Press, 2013
532 pages, $135.00
ISBN 9780521821841

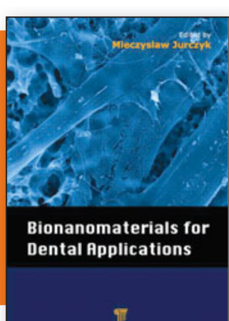
This is an excellent book on inelastic deformation and fracture of polymers from a mechanistic point of view. It is written by a leading researcher who has studied this subject at the Massachusetts Institute of Technology for more than 30 years. A large part of the book is based on the author's own contribution to the field. The book comprises 13 chapters and about 500 pages. It is concisely written yet contains sufficient details. This book is a good reference for graduate students as well as engineers in the field.

The first six chapters present a tutorial of polymer physics, including polymer chain structures, condensed states, rubber elasticity, and linear viscoelastic properties. The discussions of viscoelasticity and time-temperature superposition are insightful. Introduction of in elastic behavior of polymers starts with nonpolymeric glasses in chapter 7. This part concentrates heavily on the author's own research and addresses the general picture, such as kinematics of plasticity, nucleation of shear transformations, yielding, and post-yielding large plastic deformation. The presentation is beautiful. Chapters 8 and 9 include in-depth discussions of polymer rheology, plastic deformation and flow, kinetic models of yielding, temperature dependence, large strain deformation, and strain hardening. A number of amorphous and semicrystalline polymers are discussed individually and computer simulations of plastic deformation-induced texture development are described. Chapter 10 covers deformation instability in plastic flow, especially during necking and post-necking. Chapter 11 gives a useful description of crazing, including initiation, growth, and molecular mechanisms. Chapter 12 presents polymer material fracture behavior. Fracture, deformation at crack tips, crack propagation, and brittle-to-ductile transition of polymers are discussed comprehensively from mechanical and molecular points of view. Chapter 13 describes polymer toughening mechanisms based on crazing, plastic deformation, and cracking. Toughening with low molecular weight plasticizing diluents and dispersed rubber particles is discussed in good depth. The book also provides a nice collection of polymer property data.

This book could have been improved by incorporating an analysis of multiphase polymer toughening. Good progress has been made in analyzing toughening of plastics with rubber particles in the recent past, so it would have been appropriate to include this subject.

In summary, this book gives a coherent and insightful presentation of inelastic behaviors of polymers. It will be a lasting reference in the field.

***Reviewer: SuPing Lyu** is a Principal Scientist at Medtronic Inc., Mounds View, Minn., USA.*



Bionanomaterials for Dental Applications

Editor: Mieczyslaw Jurczyk

Pan Stanford Publishing, 2012
406 pages, $149.95
ISBN 9789814303835 (Print)
ISBN 9789814303842 (e-Book)

This book introduces readers to the structure and characteristics of nanomaterials and their applications in dentistry. With currently available implant materials, the clinical failure rate varies from a few percent to over 10% and new materials are clearly needed. Nanomaterials offer the promise of higher strength, better bonding, less toxicity, and enhanced cytocompatibility, leading to increased tissue regeneration. Mieczyslaw Jurczyk, director of the Institute of Materials Science and Engineering at the Poznan University of Technology, Poland, has drawn from work in his laboratory and elsewhere in Poland to show that nanomaterials have important biological applications including in the stomatognathic system consisting of mouth, jaws, and associated structures. The book is written from a materials science and medical point of view and has 13 chapters and about 400 pages.

The book can be divided approximately into three sections: the first five chapters introduce nanobiomaterials, the next five chapters describe their dental applications, and the last chapters describe their biocompatibility. Chapter 3 is a compendium on metallic biomaterials such as stainless steel, cobalt alloys, and titanium alloys; bioactive, bioresorbable polymers; and composites and ceramic biomaterials. The "top-down" approach to producing nanomaterials such as high-energy ball-milling and severe plastic deformation, as well as Feynman's "bottom-up technique" of building atom by atom, are discussed in the next chapter. Subsequent chapters discuss each material in depth and point out how new architectures and properties emerge at the nanoscale.