

Wolfgang Grellmann  
Beate Langer *Editors*

# Deformation and Fracture Behaviour of Polymer Materials

# Fracture Behaviour Of Polymers

**John Scheirs**



## **Fracture Behaviour Of Polymers:**

*Fracture Behaviour of Polymers* A.J. Kinloch, 2013-04-17 Over recent years there has been a tremendous upsurge in interest in the fracture behaviour of polymers. One reason for this is the increasing use of polymers in structural engineering applications since in such circumstances it is essential to have as complete an understanding as possible of the polymer's fracture behaviour. This book is designed to meet the requirements of those who need to be informed of the latest developments in the field of polymer fracture. It is written particularly for research workers but it should also prove invaluable for advanced students taking final year undergraduate or postgraduate courses. The main emphasis is upon the use of fracture mechanics in the study of polymer fracture but this approach is then developed to cover the micromechanisms of the fracture process. Particular prominence is given to the relationship between structure, mechanical properties and the mechanics and mechanisms of fracture. The first chapter is a brief introduction which has several aims. One is to introduce polymers to the reader who does not have a strong background in the subject and another is to provide background material that will be used at later stages. The book is then split into two main parts: the first deals with the mechanics and mechanisms whilst the second is concerned with materials. In Part I phenomena such as molecular fracture, fracture mechanics, shear yielding and crazing are covered from a general viewpoint.

**Fracture Behaviour of Polymers** A.J. Kinloch, 2014-03-14 Over recent years there has been a tremendous upsurge in interest in the fracture behaviour of polymers. One reason for this is the increasing use of polymers in structural engineering applications since in such circumstances it is essential to have as complete an understanding as possible of the polymer's fracture behaviour. This book is designed to meet the requirements of those who need to be informed of the latest developments in the field of polymer fracture. It is written particularly for research workers but it should also prove invaluable for advanced students taking final year undergraduate or postgraduate courses. The main emphasis is upon the use of fracture mechanics in the study of polymer fracture but this approach is then developed to cover the micromechanisms of the fracture process. Particular prominence is given to the relationship between structure, mechanical properties and the mechanics and mechanisms of fracture. The first chapter is a brief introduction which has several aims. One is to introduce polymers to the reader who does not have a strong background in the subject and another is to provide background material that will be used at later stages. The book is then split into two main parts: the first deals with the mechanics and mechanisms whilst the second is concerned with materials. In Part I phenomena such as molecular fracture, fracture mechanics, shear yielding and crazing are covered from a general viewpoint.

**Deformation and Fracture Behaviour of Polymers** Wolfgang Grellmann, 2001-06-20 This book gives an overview of recent advances in the fracture mechanics of polymers, morphology, property correlations, hybrid methods for polymer testing and polymer diagnostics and biocompatible materials and medical prostheses as well as application examples and limits.

**Deformation and Fracture Behaviour of Polymer Materials** Wolfgang Grellmann, Beate Langer, 2017-07-12 This book covers the most

recent advances in the deformation and fracture behaviour of polymer material It provides deeper insight into related morphology property correlations of thermoplastics elastomers and polymer resins Each chapter of this book gives a comprehensive review of state of the art methods of materials testing and diagnostics tailored for plastic pipes films and adhesive systems as well as elastomeric components and others The investigation of deformation and fracture behaviour using the experimental methods of fracture mechanics has been the subject of intense research during the last decade In a systematic manner modern aspects of fracture mechanics in the industrial application of polymers for bridging basic research and industrial development are illustrated by multifarious examples of innovative materials usage This book will be of value to scientists engineers and in polymer materials science *Deformation and Fracture Behaviour of Polymers* Wolfgang Grellmann, Sabine Seidler, 2014-01-15 **Polymer Fracture** H. - H. Kausch, 2012-12-06 This book on Polymer Fracture might as well have been called Kinetic Theory of Polymer Fracture The term kinetic theory however needs some definition or at least some explanation A kinetic theory deals with and particularly considers the effect of the existence and discrete size of the motion and of the physical properties of molecules on the macroscopic behavior of an ensemble gaseous or other A kinetic theory of strength does have to consider additional aspects such as elastic and anelastic deformations chemical and physical reactions and the sequence and distribution of different disintegration steps In the last fifteen years considerable progress has been made in the latter domains The deformation and rupture of molecular chains crystals and morphological structures have been intensively investigated The understanding of the effect of those processes on the strength of polymeric materials has especially been furthered by the development and application of spectroscopical methods ESR IR and of the tools of fracture mechanics It is the aim of this book to relate the conventional and successful statistical parametrical and continuum mechanical treatment of fracture phenomena to new results on the behavior of highly stressed molecular chains Polymer Properties at Room and Cryogenic Temperatures Gunther Hartwig, 1995-01-31 Most descriptions of polymers start at room temperature and end at the melting point This textbook starts at very low temperatures and ends at room temperature At low temperatures many processes and relaxations are frozen which allows singular processes or separate relaxations to be studied At room temperatures or at the main glass transitions many processes overlap and the properties are determined by relaxations At low temperatures there are temperature ranges with negligible influences by glass transitions They can be used for investigating so called basic properties which arise from principles of solid state physics The chain structure of polymers however requires stringent modifications for establishing solid state physics of polymers Several processes which are specific of polymers occur only at low temperatures There are also technological aspects for considering polymers at low temperatures More and more applications of polymeric materials in low temperature technology appear Some examples are thermal and electrical insulations support elements for cryogenic devices low loss materials for high frequency equipments It is hoped that in addition to the scientific part a data collection in

the appendix may help to apply polymers more intensively in low temperature technology The author greatly appreciates the contributions by his coworkers of the Kernforschungszentrum Karlsruhe in measurement and discussion of many data presented in the textbook and its appendix Fruitful discussions with the colleagues Prof H Baur Prof S Hunklinger Prof D Munz and Prof R

**Fracture Behavior of Nanocomposites and Reinforced Laminate Structures** Ashwani Kumar, Yogesh Kumar Singla, Michael R. Maughan, 2024-10-14 This contributed volume is designed for fundamental understanding of fracture behavior of composites applied in core industrial sectors such as mechanical electronics Automotive civil structures and aerospace research and fills the gap of knowledge on fracture analysis The book is primarily written for senior undergraduates graduate students and academic researchers in above mentioned fields

**Delamination Behaviour of Composites** Srinivasan Sridharan, 2008-10-21 Given such advantages as low weight compared to strength and toughness laminated composites are now used in a wide range of applications Their increasing use has underlined the need to understand their principal mode of failure delamination This important book reviews key research in understanding and preventing delamination The first part of the book reviews general issues such as the role of fracture mechanics in understanding delamination design issues and ways of testing delamination resistance Part two describes techniques for detecting and characterising delamination such as piezoelectric sensors the use of lamb waves and acoustic emission techniques The next two sections of the book discuss ways of studying and modelling delamination behaviour The final part of the book reviews research on delamination behaviour in particular conditions such as shell and sandwich structures z pin bridging and resin bonding With its distinguished editor and international team of contributors Delamination behaviour of composites is a standard reference for all those researching laminated composites and using them in such diverse applications as microelectronics aerospace marine automotive and civil engineering Reviews the role of fracture mechanics in understanding delamination design issues and ways of testing delamination resistance Discuss ways of studying and modelling delamination behaviour A standard reference for all those researching laminated composites

**An Introduction to the Mechanical Properties of Solid Polymers** I. M. Ward, J. Sweeney, 2004-05-31 Provides a comprehensive introduction to the mechanical behaviour of solid polymers Extensively revised and updated throughout the second edition now includes new material on mechanical relaxations and anisotropy composites modelling non linear viscoelasticity yield behaviour and fracture of tough polymers The accessible approach of the book has been retained with each chapter designed to be self contained and the theory and applications of the subject carefully introduced where appropriate The latest developments in the field are included alongside worked examples mathematical appendices and an extensive reference Fully revised and updated throughout to include all the latest developments in the field Worked examples at the end of the chapter An invaluable resource for students of materials science chemistry physics or engineering studying polymer science

**Properties of Polymers** D.W. van Krevelen, Klaas te Nijenhuis, 2009-02-09 This authoritative widely cited book has been

used all over the world Properties of Polymers Fourth Edition incorporates the latest developments in the field while maintaining the core objectives of previous editions to correlate properties with chemical structure and to describe methods that permit the estimation and prediction of numerical properties from chemical structure i e nearly all properties of the solid liquid and dissolved states of polymers Extends coverage of critical topics such as electrical and magnetic properties rheological properties of polymer melts and environmental behavior and failure Discusses liquid crystalline polymers across chapters 6 15 and 16 for greater breadth and depth of coverage Increases the number of supporting illustrations from approximately 250 in the previous edition to more than 400 to further aid in visual understanding *Handbook of Polymer Testing* Roger Brown,1999-01-21 The Handbook of Polymer Testing Physical Methods provides virtually currently used techniques for measuring and testing the physical properties of polymers A concise but detailed technical guide to the physical testing methods of synthetic polymers in plastics rubbers cellular materials textiles coated fabrics and composites the book analys **Intrinsic Molecular Mobility and Toughness of Polymers I** Hans-Henning Kausch,2005-12-01 Ce livre historique peut contenir de nombreuses coquilles et du texte manquant Les acheteurs peuvent generalement telecharger une copie gratuite scannee du livre original sans les coquilles aupres de l editeur Non reference Non illustre 1838 edition Extrait a tetat naissant et particularite relative a ce principe dans quelques legumineuses Afin de rechercher si les memes proprietes existaient dans l amidon a l etat naissant ou tres jeune j examinai cette secretion au moment ou elle se montre dans les cotyledons encore baignes par le liquide sucre de l ovule du pisum sativum Ses grains tres petits alors offrent aussi les caracteres physiques et chimiques qui precedent et ceux que nous exposerons plus loin une particularite remarquable dans leurs formes a ete decrite et figuree pi 4 fig Dans les cotyledons de la feve commune on trouve des grains d amidon plus sinueux encore L amidon extrait des haricots et des lentilles presente des grains qui se dessinent par des contours moins sinueux que les precedens Enfin l amidon en tres petite quantite dans les graines de Colutea arborescens Baguenaudier est en grains excessivement petits qui sont arrondis quoique plus ou moins irreguliers X Botak Stptrmlre i La configuration sinueuse contournee ou vermiforme observee dans plusieurs graines des legumineuses ne se retrouve donc pas dans toutes au meme degre elle offrfun exemple de plus des varietes de formes que peut affecter l amidon dans les circonstances legerement variables ou se produit cette secretion sans que les caracteres physiques essentiels ni la composition chimique soient differentes r Amidon completement epure Fractal Mechanics of Polymers G. V. Kozlov,Yu G. Yanovskii,2014-11-12 This new book explores the consideration of relationships that connect the structural and basic mechanical properties of polymeric mediums within the frameworks of fractal analysis with cluster model representations attraction Incidentally the choice of any structural model of medium or their combinations is defined by expediency and further usag *Compositional and Failure Analysis of Polymers* John Scheirs,2000-10-03 Intended as a practical guide for polymer technologists engineers and analysts in the plastics composites and rubber fields this title describes a range of

techniques and strategies for compositional and failure analysis of polymeric materials and products Numerous examples illustrate the application of analytical methods for solving commonly encountered problems in the polymer industry The reader is guided towards the most appropriate method of analysis and measurement and the most likely reasons for the failure Areas covered include Migration and interaction of additives Mechanical stress and stress cracking Crazing and fracture Residual stress and weld lines Contamination and discoloration Numerous pedagogical methods illustrative flow diagrams figures and tables are used throughout the text to make it an invaluable guide to all analysts and polymer engineers in industrial or academic laboratories      Mechanical Properties of Solid Polymers Ian M. Ward, John Sweeney, 2012-10-22

Providing an updated and comprehensive account of the properties of solid polymers the book covers all aspects of mechanical behaviour This includes finite elastic behavior linear viscoelasticity and mechanical relaxations mechanical anisotropy non linear viscoelasticity yield behavior and fracture New to this edition is coverage of polymer nanocomposites and molecular interpretations of yield e g Bowden Young and Argon The book begins by focusing on the structure of polymers including their chemical composition and physical structure It goes on to discuss the mechanical properties and behaviour of polymers the statistical molecular theories of the rubber like state and describes aspects of linear viscoelastic behaviour its measurement and experimental studies Later chapters cover composites and experimental behaviour relaxation transitions stress and yielding The book concludes with a discussion of breaking phenomena      **An Introduction to**

**Polymer Physics** David I. Bower, 2002-05-30 Publisher Description      Chemistry of Polymers John W Nicholson, 2007-10-31

The Chemistry of Polymers Third edition is a well established and highly readable introductory text book on polymer science ideal for chemists requiring a broad introduction to the subject Like its predecessors it has been written primarily from an applications point of view emphasising practical applications and providing a comprehensive introduction on all aspects of polymer science including polymer synthesis characterisation reaction kinetics and materials science Specialised topics such as polymer degradation polymers and pollution and a variety of technological developments are also discussed in an informative and up to date manner This third edition of the book has been extensively revised to include the latest developments in polymer science Highlights and updates include a new chapter on dendrimers a field of chemistry that has grown enormously in the last ten years Coverage of Special topics in polymer chemistry and Polymers in the environment have both been updated to reflect recent developments in the field including polymer recycling This text is essential reading for university students teachers and scientists who wish to acquire an up to the minute overview of polymer science and its many specialised topics in an informative and easy to read style      **Applied Polymer Science** Ulf W. Gedde, Mikael S.

Hedenqvist, Minna Hakkarainen, Fritjof Nilsson, Oisik Das, 2021-10-29 This companion volume to Fundamental Polymer Science Gedde and Hedenqvist 2019 offers detailed insights from leading practitioners into experimental methods simulation and modelling mechanical and transport properties processing and sustainability issues Separate chapters are devoted to

thermal analysis microscopy spectroscopy scattering methods and chromatography Special problems and pitfalls related to the study of polymers are addressed Careful editing for consistency and cross referencing among the chapters high quality graphics worked out examples and numerous references to the specialist literature make Applied Polymer Science an essential reference for advanced students and practicing chemists physicists and engineers who want to solve problems with the use of polymeric materials

Principles of Polymer Systems, Sixth Edition Ferdinand Rodriguez, Claude Cohen, Christopher K. Ober, Lynden Archer, 2014-12-09

Maintaining a balance between depth and breadth the Sixth Edition of Principles of Polymer Systems continues to present an integrated approach to polymer science and engineering A classic text in the field the new edition offers a comprehensive exploration of polymers at a level geared toward upper level undergraduates and beginning graduate students Revisions to the sixth edition include A more detailed discussion of crystallization kinetics strain induced crystallization block copolymers liquid crystal polymers and gels New powerful radical polymerization methods Additional polymerization process flow sheets and discussion of the polymerization of polystyrene and poly vinyl chloride New discussions on the elongational viscosity of polymers and coarse grained bead spring molecular and tube models Updated information on models and experimental results of rubber elasticity Expanded sections on fracture of glassy and semicrystalline polymers New sections on fracture of elastomers diffusion in polymers and membrane formation New coverage of polymers from renewable resources New section on X ray methods and dielectric relaxation All chapters have been updated and out of date material removed The text contains more theoretical background for some of the fundamental concepts pertaining to polymer structure and behavior while also providing an up to date discussion of the latest developments in polymerization systems Example problems in the text help students through step by step solutions and nearly 300 end of chapter problems many new to this edition reinforce the concepts presented



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