

## Creep And Fatigue In Polymer Matrix Composites Woodhead Publishing Series In Composites Science And Engineering

As a reference book, the Springer Handbook provides a comprehensive exposition of the techniques and tools of experimental mechanics. An informative introduction to each topic is provided, which advises the reader on suitable techniques for practical applications. New topics include biological materials, MEMS and NEMS, nanoindentation, digital photomechanics, photoacoustic characterization, and atomic force microscopy in experimental solid mechanics. Written and compiled by internationally renowned experts in the field, this book is a timely, updated reference for both practitioners and researchers in science and engineering.

There are many books available on polymer chemistry, properties, and processing, but they do not focus on the practicalities of selecting and using them correctly in the design of structures. Engineering students require an understanding of polymers and composites as well as viscoelasticity, adhesion, damping applications, and tribology in order to successfully integrate these materials into their designs. Based on more than twenty years of classroom experience, *Engineering Design with Polymers and Composites* is the first textbook to unite these topics in a single source. The authors take a bottom-up functional approach rather than a top-down analytical approach to design. This unique perspective enables students to select the proper materials for the application rather than force the design to suit the materials. The text begins with an introduction to polymers and composites, including historical background. Detailed coverage of mechanical properties, viscoelastic behavior of polymers, composite materials, creep and fatigue failure, impact, and related properties follows. Discussion then turns to selection of materials, design applications of polymers, polymer processing, adhesion, tribology, and damping and isolation. Abundant examples, homework problems, tables, and illustrations reinforce the concepts. Accompanied by a CD-ROM containing materials databases, examples in Excel®, and a laminate analysis program, *Engineering Design with Polymers and Composites* builds a strong background in the underlying concepts necessary for engineering students to successfully incorporate polymers and composites into their designs.

My heart sank when I was approached by Dr Hastings and by Professor Briggs (Senior Editor of Materials Science and Technology and Series Editor of Polymer Science and Technology Series at Chapman & Hall, respectively) to edit a book with the provisional title Handbook of Polypropylene. My reluctance was due to the fact that my former book [1] along with that of Moore [2], issued in the meantime, seemed to cover the information demand on polypropylene and related systems. Encouraged, however, by some colleagues (the new generation of scientists and engineers needs a good reference book with easy information retrieval, and the development with metallocene catalysts deserves a new update!), I started on this venture. Having some experience with polypropylene systems and being aware of the current literature, it was easy to settle the titles for the book chapters and also to select and approach the most suitable potential contributors. Fortunately, many of my first-choice authors accepted the invitation to contribute. Like all editors of multi-author volumes, I recognize that obtaining contributors follows an S-type curve of asymptotic saturation when the number of willing contributors is plotted as a function of time. The saturation point is, however, never reached and as a consequence, Dear Reader, you will also find some topics of some relevance which are not explicitly treated in this book (but, believe me, I have considered them).

*Polymer Interface and Adhesion* provides the critical basis for further advancement in this field. Combining the principles of interfacial science, rheology, stress analysis, and fracture mechanics, the book teaches a new approach to the analysis of long standing problems such as: how is the interface formed; what are its physical and mechanical properties; and how does the interface modify the stress field and fracture strength of the material. The book offers many outstanding features, including extensive listings of pertinent references, exhaustive tabulations of the interfacial properties of polymers, critical reviews of the many conflicting theories, and complete discussions of coupling agents, adhesion promotion, and surface modifications. Emphasis is placed on physical concepts and mechanisms, using clear, understandable mathematics. *Polymer Interface and Adhesion* promotes a more thorough understanding of the physical, mechanical, and adhesive properties of multiphase, polymer systems. Polymer scientists and engineers, surface chemists, materials scientists, rheologists, as well as chemical and mechanical engineers interested in the research, development or industrial applications of polymers, plastics, fibers, coatings, adhesives, and composites need this important news source book.

The stability and resistance of polymeric materials determine whether they can be utilized in a given application. Authoritative and reliable material information is needed during the material selection process and this information must consider the influences of material manufacturing, compounding and stabilization, processing, part design, use and subsequent disposal/recycling. This book is based on the review of more than 1200 literature sources and represents a comprehensive overview of the current know-how regarding the stability and resistance of thermoplastics, thermosets, elastomers as well as the most commonly used reinforcements and additives. Extensive tables document material resistance to given media, facilitating appropriate material selection or stabilization for a given application. Contents Volume 1: Principles of Aging Testing Methods Stabilization Influence of Processing and Use Resistance to Thermal and Thermal-Oxidative Loads, Weathering, Chemicals, Ionizing Radiation, Microorganisms, Biological Influences, and Mechanical Loads Creep and Fatigue of Reinforced Polymers Contents Volume 2: Chemical Resistance Tables White Lists of Media Influence (According to DIBt) References Index

A balanced mechanics-materials approach and coverage of the latest developments in biomaterials and electronic materials, the new edition of this popular text is the most thorough and modern book available for upper-level undergraduate courses on the mechanical behavior of materials. To ensure that the student gains a thorough understanding the authors present the fundamental mechanisms that operate at micro- and nano-meter level across a wide-range of materials, in a way that is mathematically simple and requires no extensive knowledge of materials. This integrated approach provides a conceptual presentation that shows how the microstructure of a material controls its mechanical behavior, and this is reinforced through extensive use of micrographs and illustrations. New worked examples and exercises help the student test their understanding. Further resources for this title, including lecture slides of select illustrations and solutions for exercises, are available online at [www.cambridge.org/97800521866758](http://www.cambridge.org/97800521866758).

This proceedings covers the general problem related to the damage initiation and development, the failure criteria and the specific aspects related to fatigue, creep behaviour, moisture diffusion and the problem of the joining systems.

The selection and application of engineered materials is an integrated process that requires an understanding of the interaction between materials properties, manufacturing characteristics, design considerations, and the total life cycle of the product. This reference book on engineering plastics provides practical and comprehensive coverage on how the performance of plastics is characterized during design, property testing, and failure analysis. The fundamental structure and properties of plastics are reviewed for general reference, and detailed articles describe the important design factors, properties, and failure mechanisms of plastics. The effects of composition, processing, and structure are detailed in articles on the physical, chemical, thermal, and mechanical properties. Other articles cover failure mechanisms such as: crazing and fracture; impact loading; fatigue failure; wear failures, moisture related failure; organic chemical related failure; photolytic degradation; and microbial degradation. Characterization of plastics in failure analysis is described with additional articles on analysis of structure, surface analysis, and fractography.

Second edition of successful materials science text for final year undergraduate and graduate students.

The sub volumes A of volume VIII/6 form a series of data collections and handbooks covering properties of polymer solids and polymer melts. The present volume forms the third part of it and compiles concepts and data concerning thermomechanical, mechanical and fracture-mechanical properties of pure, filled and reinforced thermoplastics, thermo sets and high-performance composites.

Because the field of plastics is one of the fastest changing areas today, the need arises to offer relevant, comprehensive material on polymers. An established source of information on modern plastics, the Plastics Technology Handbook continues to provide up-to-date coverage on the properties, processing methods, and applications of polymers. Retaining the easy-to-follow structure of the previous editions, this fourth edition includes new topics of interest that reflect recent developments and lead to better insights into the molecular behavior of polymers. New to the Fourth Edition Advances in supramolecular polymerization, flame retardancy, polymer-based nanomedicines, and drug delivery The new concept of oxo-biodegradable polymers Broadened discussion on plastic foams and foam extrusion processes More information on the processing and applications of industrial polymers, including the emerging field of nanoblends Developments in polymer synthesis and applications, such as polymeric sensors, hydrogels and smart polymers, hyperbranched polymers, shape memory polymers, polymeric optical fibers, scavenger resins, polymer nanocomposites, polymerization-filled composites, and wood-polymer composites A state-of-the-art account of the various available methods for plastics recycling Advances in the use of polymers in packaging, construction, the automotive and aerospace industries, agriculture, electronics and electrical technology, biomedical applications, corrosion prevention, and sports and marine applications Plastics Technology Handbook, Fourth Edition thoroughly covers traditional industrial polymers and their processing methods as well as contemporary polymeric materials, recent trends, and the latest applications.

This book provides the first comprehensive review of its kind on the long-term behaviour of composite materials and structures subjected to time variable mechanical, thermal, and chemical influences, a subject of critical importance to the design, development, and certification of high performance engineering structures. Specific topics examined include damage, damage characterization, and damage mechanics; fatigue testing and evaluation; fatigue behaviour of short and long fibre reinforced polymer and metal matrix materials; viscoelastic and moisture effects; delamination; statistical considerations; the modeling of cumulative damage development; and life prediction. The volume provides an extensive presentation of data, discussions, and comparisons on the behaviour of the major types of material systems in current use, as well as extensive analysis and modeling (including the first presentation of work not found elsewhere). The book will be of special interest to engineers concerned with reliability, maintainability, safety, certification, and damage tolerance; to materials developers concerned with making materials for long-term service, especially under severe loads and environments, and to lecturers, students, and researchers involved in material system design, performance, solid mechanics, fatigue, durability, and composite materials. The scope of the work extends from entry level material to the frontiers of the subject.

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.

The result of the authors' 40 years of experience in durability testing, this book describes the advanced testing methodology based on the viscoelasticity of matrix polymer. After a short introduction to the viscoelastic behavior of fiber-reinforced plastics, the text goes on to review in detail the concepts of static, fatigue and creep strengths in polymer composites. An application-oriented approach is adopted such that the concepts developed in the book are applied to real-life examples. Indispensable information for materials scientists and engineers working in those industrial sectors is concerned with the development and safe use of polymer composite-based products.

Fatigue and fracture result in billions of dollars of damage each year. This book examines the various causes of fatigue including crack growth, defects, temperature, environmental, and corrosion.

Creep and Fatigue in Polymer Matrix Composites, Second Edition, updates the latest research in modeling and predicting creep and fatigue in polymer matrix composites. The first part of the book reviews the modeling of viscoelastic and viscoplastic behavior as a way of predicting performance and service life. Final sections discuss techniques for modeling creep rupture and failure and how to test and predict long-term creep and fatigue in polymer matrix composites. Reviews the latest research in modeling and predicting creep and fatigue in polymer matrix composites Puts a specific focus on viscoelastic and viscoplastic modeling Features the time-temperature-age superposition principle for predicting long-term response Examines the creep rupture and damage interaction, with a particular focus on time-dependent failure criteria for the lifetime prediction of polymer matrix composite structures that are illustrated using experimental cases

This book provides a unified mechanics and materials perspective on polymers: both the mathematics of viscoelasticity theory as well as the physical mechanisms behind polymer deformation processes. Introductory material on fundamental mechanics is included to provide a continuous baseline for readers from all disciplines. Introductory material on the chemical and molecular basis of polymers is also included, which is essential to the understanding of the thermomechanical response. This self-contained text covers the viscoelastic characterization of polymers including constitutive modeling, experimental methods, thermal response, and stress and failure analysis. Example problems are provided within the text as well as at the end of each chapter. New to this edition: · One new chapter on the use of nano-material inclusions for structural polymer applications and applications such as fiber-reinforced polymers and adhesively bonded structures · Brings up-to-date polymer production and sales data and equipment and procedures for evaluating polymer characterization and classification · The work serves as a comprehensive reference for advanced seniors seeking graduate level courses, first and second year graduate students, and practicing engineers

Recent investigations into blast-resistant properties of polyureas and other multi-phase polymeric elastomers indicate that they can dissipate broad bands of frequencies such as those encountered in blast events. In this unique book, Elastomeric Polymers with High Rate Sensitivity, Dr. Roshdy Barsoum and expert contributors bring together the cutting-edge testing methodologies, material properties, and critical design data for engineers seeking to deploy this technology. Where conventional methods of resisting blast, shockwave, and penetration are expensive, time-consuming and impractical, high-strain rate elastomeric polymers (HSREP) can be cheaper, quicker, and more easily applied to new and old materials alike. This book aids both military and civilian engineers in a range of applications, from buildings and tunnels to lightweight armor, ships, and aircraft. The book features constitutive models for software developers designing with these advanced polymers, as well as a discussion of the mechanisms of interaction between high-strain rate polymers and other materials. It also thoroughly covers HSREP engineering methods to achieve other unique properties, such as fireproofing. Material properties and design data included to enable engineers to successfully deploy this technology Cheaper, quicker, and more easily implemented than traditional methods of increasing blast and ballistic performance A how-to guide to the engineering of high strain rate elastomeric polymers to achieve other useful properties, such as fireproofing

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"Long Term Durability of Structural Materials" features proceedings of the workshop held at Berkeley, CA in October, 2000. It brought together engineers and scientists, who have received grants from the initiative NSF 98-42, to share their results on the study of long-term durability of materials and structures. The major objective was to develop new methods for accelerated short-term laboratory or in-situ tests which allow accurate, reliable, predictions of the long-term performance of materials, machines and structures. To achieve this goal it was important to understand the fundamental nature of the deterioration and damage processes in materials and to develop innovative ways to model the behavior of these processes as they affect the life and long-term performance of components, machines and structures. The researchers discussed their approach to include size effects in scaling up from laboratory specimens to actual structures. Accelerated testing and durability modeling techniques developed were validated by comparing their results with performance under actual operating conditions. The main mechanism of the deterioration discussed included environmental effects and/or exposure to loads, speeds and other operating conditions that are not fully anticipated in the original design. A broad range of deterioration damage, such as fatigue, overload, ultraviolet damage, corrosion, and wear was presented. A broad range of materials of interest was also discussed, including the full spectrum of construction materials, metals, ceramics, polymers, composites, and coatings. Emphasis was placed on scale-dependence and history of fabrication on resulting mechanical behavior of materials.



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.

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.

Rubber Nanocomposites: Preparation, Properties and Applications focuses on the preparation, characterization and properties of natural and synthetic rubber nanocomposites. The book carefully debates the preparation of unmodified and modified nanofillers, various manufacturing techniques of rubber nanocomposites, structure, morphology and properties of nanocomposites. The text reviews the processing; characterization and properties of 0-, 1D and 2D nanofiller reinforced rubber nanocomposites. It examines the polymer/filler interaction, i.e., the compatibility between matrix and filler using unmodified and modified nanofillers. The book also examines the applications of rubber nanocomposites in various engineering fields, which include tyre engineering. The book also examines the current state of the art, challenges and applications in the field of rubber nanocomposites. The handpicked selection of topics and expert contributions make this survey of rubber nanocomposites an outstanding resource for anyone involved in the field of polymer materials design. A handy "one stop" reference resource for important research accomplishments in the area of rubber nanocomposites. Covers the various aspects of preparation, characterization, morphology, properties and applications of rubber nanocomposites. Summarizes many of the recent technical research accomplishments in the area of nanocomposites, in a comprehensive manner It covers an up to date record on the major findings and observations in the field

"This book emphasizes the physical and practical aspects of fatigue and fracture. It covers mechanical properties of materials, differences between ductile and brittle fractures, fracture mechanics, the basics of fatigue, structural joints, high temperature failures, wear, environmentally-induced failures, and steps in the failure analysis process."--publishers website.

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.

The paper concerns the time-dependent behavior of electroactive polymers (EAPs) and their use in advanced intelligent structures for space exploration. Innovative actuator design for low weight and low power valves required in small plants planned for use on the moon for chemical analysis is discussed. It is shown that in-depth understanding of cyclic loading effects observed through accelerated creep rates due to creep-fatigue interaction in polymers is critical in terms of proper functioning of EAP based actuator devices. In the paper, an overview of experimental results concerning the creep properties and cyclic creep response of a thin film piezoelectric polymer polyvinylidene fluoride is presented. The development of a constitutive creep-fatigue interaction model to predict the durability and service life of EAPs is discussed. A novel method is proposed to predict damage accumulation and fatigue life of polymers under cyclic loading conditions in the presence of creep. The study provides a basis for ongoing research initiatives at the National Aeronautics and Space Administration Kennedy Space Center in the pursuit of new technologies using EAP as active elements for lunar exploration systems.

A concise, self-contained introduction to solid polymers, the mechanics of their behavior and molecular and structural interpretations. This updated edition provides extended coverage of recent developments in rubber elasticity, relaxation transitions, non-linear viscoelastic behavior, anisotropic mechanical behavior, yield behavior of polymers, breaking phenomena, and other fields.

Reflecting his major contributions to the field, Jean Lemaitre's "Engineering Damage Mechanics" presents simplified and advanced methods organized within a unified framework for designers of any mechanical component. Explains how to apply continuous damage mechanics to failures of mechanical and civil engineering components in ductile, creep, fatigue and brittle conditions. Incorporates many basic examples, while emphasizing key practical considerations such as material parameter identification, and provides perspective on the advantage and disadvantages of various approaches.

This book contains analysis of reasons that cause products to fail. General methods of product failure evaluation give powerful tools in product improvement. Such methods, discussed in the book, include practical risk analysis, failure mode and effect analysis, preliminary hazard analysis, progressive failure analysis, fault tree analysis, mean time between failures, Wohler curves, finite element analysis, cohesive zone model, crack propagation kinetics, time-temperature collectives, quantitative characterization of fatigue damage, and fracture maps. Methods of failure analysis are critical to for material improvement and they are broadly discussed in this book. Fractography of plastics is relatively a new field which has many commonalities with fractography of metals. Here various aspects of fractography of plastics and metals are compared and contrasted. Fractography application in studies of static and cycling loading of ABS is also discussed. Other methods include SEM, SAXS, FTIR, DSC, DMA, GC/MS, optical microscopy, fatigue behavior, multiaxial stress, residual stress analysis, punch resistance, creep-rupture, impact, oxidative induction time, craze testing, defect analysis, fracture toughness, activation energy of degradation. Many references are given in this book to real products and real cases of their failure. The products discussed include office equipment, automotive compressed fuel gas system, pipes, polymer blends, blow molded parts, layered, cross-ply and continuous fiber composites, printed circuits, electronic packages, hip implants, blown and multilayered films, construction materials, component housings, brake cups, composite pressure vessels, swamp coolers, electrical cables, plumbing fittings, medical devices, medical packaging, strapping tapes, balloons, marine coatings, thermal switches, pressure relief membranes, pharmaceutical products, window profiles, and bone cements.

When fibres in a composite are discontinuous and are shorter than a few millimetres, the composite is called a 'short fibre reinforced composite (SFRP)'. SFRPs have found extensive applications in automobiles, business machines, durable consumer items, sporting goods and electrical industries owing to their low cost, easy processing and superior mechanical properties over the parent polymers. The book summarises recent developments in this area, focusing on the fundamental mechanisms that govern the mechanical properties including strength, modulus, fracture toughness and thermal properties of SFRP materials. This book covers the following topics: extrusion compounding and injection moulding, major factors affecting mechanical performance, stress transfer, strength, elastic modulus flexural modulus, thermal conductivity and expansion, non-linear stress-strain behaviour and fracture mechanics of short fibre reinforced polymers. With its distinguished team of authors, Science and engineering of short fibre reinforced polymer composites is a standard reference for anyone involved in the development, manufacture and use of SFRPs. It will also provide an in-depth understanding of the behaviour of these versatile materials. Reviews the mechanical properties and functions of short fibre reinforced polymer composites (SFRP) Examines recent developments in the fundamental mechanisms of SFRP's Assesses major factors affecting mechanical performance such as stress transfer and strength

How do engineering materials deform when bearing mechanical loads? To answer this crucial question, the book bridges the gap between continuum mechanics and materials science. The different kinds of material deformation are explained in detail. The book also discusses the physical processes occurring during the deformation of all classes of engineering materials and shows how these materials can be strengthened to meet the design requirements. It provides the knowledge needed in selecting the appropriate engineering material for a certain design problem. This book is both a valuable textbook and a useful reference for graduate students and practising engineers.

Given such properties as low density and high strength, polymer matrix composites have become a widely used material in the aerospace and other industries. Polymer matrix composites and technology provides a helpful overview of these materials, their processing and performance. After an introductory chapter, part one reviews the main reinforcement and matrix materials used as well as the nature of the interface between them. Part two discusses forming and molding technologies for polymer matrix composites. The final part of the book covers key aspects of performance, including tensile, compression, shear and bending properties as well as impact, fatigue and creep behaviour. Polymer matrix composites and technology provides both students and those in industry with a valuable introduction to and overview of this important class of materials. Provides a helpful overview of these materials, their processing and performance incorporating naming and classification of composite materials Reviews the main reinforcement and matrix materials used as well as the nature of the interface between them including damage mechanisms Discusses forming and molding technologies for polymer matrix composites outlining various techniques and technologies

This book contains 12 chapters with original and innovative research studies in the issues related to the broadly defined creep effect, which concerns not only the area of construction materials but also natural phenomena. The emphasis on the discussion of a new trend of experimental creep testing, which binds the classic creep methods to seek the correlation of parameters obtained in tests, deserves particular attention. This book aims to provide the readers, including, but not limited to, students and doctoral students and also the research personnel and engineers involved in the operation of equipment and structural components as well as specialists in high-temperature creep-resisting materials, with a comprehensive review of new trends in the field of creep-exposed materials and their research methodology. The chapters of this book were developed by respected and well-known researchers from different countries.

AEPA '96 provides a forum for discussion on the state-of-art developments in plasticity. An emphasis is placed on the close interaction of the theories from macroplasticity, mesoplasticity and microplasticity together with their applications in various engineering disciplines such as solid mechanics, metal forming, structural analysis, geo-mechanics and micromechanics. These proceedings include over 140 papers from the conference including case studies showing applications of plasticity in inter-disciplinary or nonconventional areas.

Recent progress in enhancing and refining the performance and properties of wood composites by chemical and thermal modification and the application of smart multi-functional coatings have made them a particular area of interest for researchers. Wood Composites comprehensively reviews the whole field of wood composites, with particular focus on their materials, applications and engineering and scientific advances, including solutions inspired biomimetrically by the structure of wood and wood composites. Part One covers the materials used for wood composites and examines wood microstructure, and wood processing and adhesives for wood composites. Part Two explores the many applications of wood composites, for example plywood, fibreboard, chipboard, glulam, cross-laminated timber, I-beams and wood-

polymer composites. The final part investigates advances in wood composites and looks at the preservation and modification of wood composites, environmental impacts and legislative obligations, nano-coatings and plasma treatment, biomimetic composite materials, the integration of wood composites with other materials and carbonized and mineralized wood composites. Comprehensively reviews the entire field of wood composites in a single volume Examines recent progress in enhancing and refining the performance and properties of wood composites by chemical and thermal modification and the application of smart multi-functional coatings Explores the range of wood composites, including both new and traditional products

Because of the sheer size of the plastics industry, the title *Developments in Plastics Technology* now covers an incredibly wide range of subjects or topics. No single volume can survey the whole field in any depth and so what follows is therefore a series of chapters on selected topics. The topics were selected by us, the editors, because of their immediate relevance to the plastics industry. When one considers the materials produced and used by the modern plastics industry, there is a tendency to think of the commodity thermoplastics (such as poly(vinyl chloride) or polyethylene); the thermosetting materials are largely ignored. Because of this attitude we are very pleased to include in this volume a chapter which deals with the processing of a thermosetting material, i.e. the pultrusion of glass reinforced polyester. The extrusion of plastics is, of course, a very important subject but an aspect which is often overlooked is the need to remove volatile matter during processing: for this reason we have included a chapter on devolatilisation. Current industrial practice is towards materials modification and this attitude is reflected in the chapters on the transformation of ethylene vinyl acetate polymers and the use of wollastonite in two important thermoplastics. When assessing the performance of materials, there is a tendency to concentrate on short-term mechanical tests and ignore such topics as fatigue and longer-term testing. We are therefore very pleased to include a chapter on this subject.

The proceedings of the International Congress (c) include about 120 papers selected out of 160 papers submitted for presentations at APCF/SIF-2014, to be held in Sydney, Australia, December 9-12, 2014, and uniting the Asian-Pacific Conference on Fracture and Strength 2014 (APCFS-2014) with the International Conference on Structural Integrity and Failure (SIF-2014). The congress will be hosted by The University of Sydney and co-organized by Australia Fracture Group (AFG), the Chinese Mechanical Engineering Society, Materials Institution (CMES-MI), the Korean Society of Mechanical Engineers, Materials and Fracture Division (KSME-MFD) and The Japanese Society of Mechanical Engineers, Materials and Mechanics Division (JSME-MMD). The congress follows the series of the previous very successful APCF and SIF international forums, in particular, APCFS 2012, Busan and the 8th SIF, Melbourne, 2013. Characterisations of complex mechanisms of damage accumulation and failure Application of new multi-scale modelling approaches in problems associated with structural integrity Development of more accurate technologies for structural damage assessment

TRIBOLOGY – the study of friction, wear and lubrication – impacts almost every aspect of our daily lives. The Springer Encyclopedia of Tribology is an authoritative and comprehensive reference covering all major aspects of the science and engineering of tribology that are relevant to researchers across all engineering industries and related scientific disciplines. This is the first major reference that brings together the science, engineering and technological aspects of tribology of this breadth and scope in a single work. Developed and written by leading experts in the field, the Springer Encyclopedia of Tribology covers the fundamentals as well as advanced applications across material types, different length and time scales, and encompassing various engineering applications and technologies. Exciting new areas such as nanotribology, tribochemistry and biotribology have also been included. As a six-volume set, the Springer Encyclopedia of Tribology comprises 1630 entries written by authoritative experts in each subject area, under the guidance of an international panel of key researchers from academia, national laboratories and industry. With alphabetically-arranged entries, concept diagrams and cross-linking features, this comprehensive work provides easy access to essential information for both researchers and practicing engineers in the fields of engineering (aerospace, automotive, biomedical, chemical, electrical, and mechanical) as well as materials science, physics, and chemistry.

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