

Advanced Composite Materials For Automotive Applications Structural Integrity And Crashworthiness

Advanced Composite Materials for Automotive Applications Structural Integrity and Crashworthiness John Wiley & Sons

This book presents a global view of the development and applications of technical textiles with the description of materials, structures, properties, characterizations, functions and relevant production technologies, case studies, challenges, and opportunities. Technical textile is a transformative research area, dealing with the creation and studies of new generations of textiles that hoist many new scientific and technological challenges that have never been encountered before. The book emphasizes more on the principles of textile science and technology to provide solutions to several engineering problems. All chapter topics are exclusive and selectively chosen and designed, and they are extensively explored by different authors having specific knowledge in each area.

A design reference for engineers developing composite components for automotive chassis, suspension, and drivetrain applications This book provides a theoretical background for the development of elements of car suspensions. It begins with a description of the elastic-kinematics of the vehicle and closed form solutions for the vertical and lateral dynamics. It evaluates the vertical, lateral, and roll stiffness of the vehicle, and explains the necessity of the modelling of the vehicle stiffness. The composite materials for the suspension and powertrain design are discussed and their mechanical properties are provided. The book also looks at the basic principles for the design optimization using composite materials and mass reduction principles. Additionally, references and conclusions are presented in each chapter. Design and Analysis of Composite Structures for Automotive Applications: Chassis and Drivetrain offers complete coverage of chassis components made of composite materials and covers elastokinematics and component compliances of vehicles. It looks at parts made of composite materials such as stabilizer bars, wheels, half-axes, springs, and semi-trail axles. The book also provides information on leaf spring assembly for motor vehicles and motor vehicle springs comprising composite materials. Covers the basic principles for the design optimization using composite materials and mass reduction principles Evaluates the vertical, lateral, and roll stiffness of the vehicle, and explains the modelling of the vehicle stiffness Discusses the composite materials for the suspension and powertrain design Features closed form solutions of problems for car dynamics explained in details and illustrated pictorially Design and Analysis of Composite Structures for Automotive Applications: Chassis and Drivetrain is recommended primarily for engineers dealing with suspension design and development, and those who graduated from automotive or mechanical engineering courses in technical high school, or in other higher engineering schools. Polymer-based fibre-reinforced composites FRC's have now come out as a major class of structural materials being used or regarded as substituent's for metals in several critical components in space, automotive and other industries (marine, and sports goods) owing to their low density, strength-weight ratio, and fatigue strength. FRC's have several commercial as well as industrial applications ranging from aircraft, space, automotive, sporting goods, marine, and infrastructure. The above-mentioned applications of FRC's clearly reveal that FRC's have the potential to be used in a broad range of different engineering fields with the added advantages of low density, and resistance to corrosion compared to conventional metallic and ceramic composites. However, for scientists/researchers/R&D's to fabricate FRC's with such potential there should be careful and precise design followed by suitable process development based on properties like mechanical, physical, and thermal that are unique to each application. Hence the last few decades have witnessed considerable research on fibre

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reinforced composites. *Fibre Reinforced Composites: Constituents, Compatibility, Perspectives and Applications* presents a widespread all-inclusive review on fibre-reinforced composites ranging from the different types of processing techniques to chemical modification of the fibre surface to enhance the interfacial adhesion between the matrix and fibre and the structure-property relationship. It illustrates how high value composites can be produced by efficient and sustainable processing methods by selecting different constituents [fibres and resins]. Researchers in academia working in composites and accompanying areas [materials characterisation] and industrial manufacturers who need information on composite constituents and how they relate to each other for a certain application will find the book extremely useful when they need to make decisions about materials selection for their products. Focuses on the different types of FRC's that are currently available (e.g. from polymeric matrices to metallic and ceramic matrices, from carbon fibre to different types of natural fibres and from short to long fibre reinforced), their processing techniques, characterization of different properties, and how to improve the interfacial adhesion between an incompatible fibre and matrix and their applications Looks at crisis areas such as how to incorporate incompatible fibres and matrices together (e.g. Non-polar polypropylene matrix is not compatible with that of polar natural fibres and hence suitable surface modifications are required to make them compatible with each other) along with low cost processing methods, low density and high strength Uncovers clarifications to both elementary and practical problems related to the fabrication of FRCs Schematic representations depicting the interaction between different fibre types and matrices will be provided in some chapters

Composite materials are a major growth area within advanced materials and the range of applications for such products continues to grow and increase in diversity with every new development. Composite products are highly in demand and reached sales of \$21.2 billion globally in 2014. The top three market segments in 2014 were transportation, construction, pipes, and tanks. Other segments include energy, automotive, and aerospace. This state-of-the-art book has been written by high-profile authors who have extensive experience and knowledge in the field of composite materials. The chapters in this collection would be useful for a wide range of audience: undergraduate and post-graduate students, industrial professionals, materials scientists and researchers, and composite manufacturers. This book provides the reader with a wide range of information in the interdisciplinary subject area of composite materials. The book consists of thirteen chapters. It deals with two types of nanocomposites: graphene and carbon nanotube reinforced nanocomposites, their manufacturing, properties and applications. It also presents fibre reinforced composites and a comprehensive review of bio-composites. Furthermore, it has a focus on thermal, mechanical and electrical properties of advanced composite materials.

Biocomposite and Synthetic Composites for Automotive Applications provides a detailed review of advanced macro and nanocomposite materials and structures, and discusses their use in the transport industry, specifically for automotive applications. This book covers materials selection, properties and performance, design solutions, and manufacturing techniques. A broad range of different material classes are reviewed with emphasis on advanced materials and new research pathways where composites can be derived from agricultural waste in the future, as well as the development and performance of hybrid composites. The book is an essential reference resource for those researching materials development and industrial design engineers who need a detailed understanding of materials usage in transport structures. Life Cycle Assessment (LCA) analysis of composite products in automotive applications is also discussed, and the effect of different fiber orientation on crash performance. Synthetic/natural fiber composites for aircraft engine fire-designated zones are linked to automotive applications. Additional chapters include the application and use of magnesium composites compared to biocomposites in the automotive industry; autonomous inspection and repair of aircraft composite structures via vortex robot technology and its application in automotive

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applications; composites in a three-wheeler (tuk tuk); and thermal properties of composites in automotive applications. Covers advanced macro and nanocomposites used in automotive structures Emphasizes materials selection, properties and performance, design solutions, and manufacturing techniques Features case studies of successful applications of biocomposites in automotive structures

The increasing use of composite materials over conventional materials has been a continual trend for over a decade. While the fundamental understanding of fiber reinforcement has not changed, many new material advancements have occurred, especially in manufacturing methods, and there is an ever-growing number of composite material applications across various industries. Polymer-Based Composites: Design, Manufacturing, and Applications presents the concepts and methods involved in the development of various fiber-reinforced composite materials. Features: Offers a comprehensive view of materials, mechanics, processing, design, and applications Bridges the gap between research, manufacturing science, and analysis and design Discusses composite materials composed of continuous synthetic fibers and matrices for use in engineering structures Presents codes and standards related to fiber-reinforced polymer composites Includes case studies and examples based on industrial, automotive, aerospace, and household applications This book is a valuable resource for advanced students, researchers, and industry personnel to understand recent advances in the field and achieve practical results in the development, manufacture, and application of advanced composite materials.

The book presents the best articles presented by researchers, academicians and industrial experts in the International Conference on “Innovative Design, Analysis and Development Practices in Aerospace and Automotive Engineering”. The book discusses new concept designs, analysis and manufacturing technologies, where more swing is for improved performance through specific and/or multifunctional linguistic design aspects to downsize the system, improve weight to strength ratio, fuel efficiency, better operational capability at room and elevated temperatures, reduced wear and tear, NVH aspects while balancing the challenges of beyond Euro IV/Barat Stage IV emission norms, Greenhouse effects and recyclable materials. The innovative methods discussed in the book will serve as a reference material for educational and research organizations, as well as industry, to take up challenging projects of mutual interest.

Repair of Polymer Composites: Methodology, Techniques, and Challenges discusses fundamental issues related to the repair of composites and their suitability in various industrial sectors, such as aerospace, automotive, marine and construction, etc. The repair of composites is complex and requires a thorough understanding of the various types of damage mechanisms in order to apply the appropriate NDT techniques. This book explores these issues in significant detail and presents systematic procedures and methods, thus serving as a useful reference for both undergraduate and postgraduate students, academic researchers, engineers and other professionals who are interested in this exciting field of research. Discusses fundamental issues related to the repair of composites and their suitability in various industrial sectors, including aerospace, automotive, marine and construction, etc. Provides comprehensive coverage, from the fundamental aspects, to real applications Serves as a useful reference for both undergraduate and postgraduate students, academic researchers, engineers and other professionals Presents different types of repair techniques by

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correlating different parameters and challenges

Green Composites for Automotive Applications presents cutting-edge, comprehensive reviews on the industrial applications of green composites. The book provides an elaborative assessment of both academic and industrial research on eco-design, durability issues, environmental performance, and future trends. Particular emphasis is placed on the processing and characterization of green composites, specific types of materials, such as thermoset and thermoplastic, nanocomposites, sandwich, and polymer biofoams. Additional sections cover lifecycle and risk analysis. As such, this book is an essential reference resource for R&D specialists working in materials science, automotive, chemical, and environmental engineering, as well as R&D managers in industry. Contains contributions from leading experts in the field Covers experimental, analytical and numerical analysis Deals with most important automotive aspects Provides a special section dedicated to lifecycle assessment

Automotive Plastics and Composites: Materials and Processing is an essential guide to the use of plastic and polymer composites in automotive applications, whether in the exterior, interior, under-the-hood, or powertrain, with a focus on materials, properties, and processing. The book begins by introducing plastics and polymers for the automotive industry, discussing polymer materials and structures, mechanical, chemical, and physical properties, rheology, and flow analysis. In the second part of the book, each chapter is dedicated to a category of material, and considers the manufacture, processing, properties, shrinkage, and possible applications, in each case. Two chapters on polymer processing provide detailed information on both closed-mold and open-mold processing. The final chapters explain other key aspects, such as recycling and sustainability, design principles, tooling, and future trends. This book is an ideal reference for plastics engineers, product designers, technicians, scientists, and R&D professionals who are looking to develop materials, components, or products for automotive applications. The book also intends to guide researchers, scientists, and advanced students in plastics engineering, polymer processing, and materials science and engineering. Analyzes mechanical, chemical, physical, and thermal properties, enabling the reader to select the appropriate material for specific applications Explains polymer processing, with thorough coverage of operations across both closed-mold and open-mold processing Provides systematic coverage of materials, including commodity and engineering thermoplastics, bio-based plastics, thermosets, composites, elastomeric polymers, and 3D-printed plastics

Whether repairing existing components, fabricating new ones, building a race car, or restoring a classic, this is the one book to guide the reader through each critical stage.

The book is a mixutre of theory and how-to. The theoretical parts will help you decide what types of goods are appropriate for composite construction, and how to design them; the how-to sections are sufficiently detailed that even a

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novice should be able to successfully fabricate those goods.

An analysis is presented of the potential use of advanced composite materials (ACM) in automotive structures based on the relative mechanical properties and costs of these materials and mild steel. The potential weight reduction obtainable by substituting ACM for steel in various components was analyzed on a functionally equivalent basis for a wide variety of fiber composites and system geometries. ACM considered were resin matrix, graphite fiber, graphite fiber/glass hybrid composites, and glass fiber composites. Continuous fiber glass composites can offer significant weight reduction in selected applications while potentially offering cost savings to the manufacturer. Graphite glass hybrids offer the potential for increased weight reduction but would currently cost more to manufacturers. However, at graphite prices of \$6/lb to \$10/lb, these hybrids would be competitive with steel in terms of manufacturing costs, and less expensive than either steel or fiber glass composites on a life cycle basis. If all graphite fiber composites were used, a further weight decrease would be obtained, but at a prohibitively high increase in manufacturing and life cycle vehicle costs. Additional problems and issues to be resolved prior to extensive use of ACM in production vehicles are also discussed.

Automotive manufacturers are required to decrease CO₂ emissions and increase fuel economy while assuring driver comfort and safety. In recent years, there has been rapid development in the application of lightweight and sustainable materials in the automotive industry to help meet these criteria. This book provides critical reviews and the latest research results of various lightweight and sustainable materials in automotive applications. It discusses current applications and future trends of lightweight materials in the automotive area. While there are a few books published mainly focusing on automotive applications of metallic lightweight materials, to date there is no available book focusing on a broad spectrum of lightweight materials, including metal, plastic, composites, bio-fiber, bio-polymer, carbon fiber, glass fiber, nanomaterials, rubber materials, and foaming materials, as this work does. The book also includes case studies of commercial lightweight automotive parts from sustainable lightweight materials, providing an invaluable resource to those involved in this in-demand research and commercialization area.

This book is an updated and expanded version of the course notes for the Composite Awareness course run by the Warwick Manufacturing Group in 1998-1999. The book gives readers an appreciation of composites, materials properties, manufacturing technologies and the wider implications of using composites in the automotive sector. It will be useful for those already working with composites in automotive applications and for those who are considering using them in the future.

Numerical Modelling of Failure in Advanced Composite Materials comprehensively examines the most recent analysis techniques for advanced composite materials. Advanced composite materials are becoming increasingly important for

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lightweight design in aerospace, wind energy, and mechanical and civil engineering. Essential for exploiting their potential is the ability to reliably predict their mechanical behaviour, particularly the onset and propagation of failure. Part One investigates numerical modeling approaches to interlaminar failure in advanced composite materials. Part Two considers numerical modelling approaches to intralaminar failure. Part Three presents new and emerging advanced numerical algorithms for modeling and simulation of failure. Part Four closes by examining the various engineering and scientific applications of numerical modeling for analysis of failure in advanced composite materials, such as prediction of impact damage, failure in textile composites, and fracture behavior in through-thickness reinforced laminates. Examines the most recent analysis models for advanced composite materials in a coherent and comprehensive manner Investigates numerical modelling approaches to interlaminar failure and intralaminar failure in advanced composite materials Reviews advanced numerical algorithms for modeling and simulation of failure Examines various engineering and scientific applications of numerical modelling for analysis of failure in advanced composite materials Advanced composite materials or high performance polymer composites are an unusual class of materials that possess a combination of high strength and modulus and are substantially superior to structural metals and alloys on an equal weight basis. The book provides an overview of the key components that are considered in the design of a composite, of surface chemistry, of analyses/testing, of structure/property relationships with emphasis on compressive strength and damage tolerance. Newly emerging tests, particularly open hole compression tests are expected to provide greater assurance of composite performance. This publication is an "up-to-date" treatment of leading edge areas of composite technology with literature reviewed until recently and includes thermoplastic prepregs/composites and major application areas.

The automotive industry faces many challenges, including increased global competition, the need for higher-performance vehicles, a reduction in costs and tighter environmental and safety requirements. The materials used in automotive engineering play key roles in overcoming these issues: ultimately lighter materials mean lighter vehicles and lower emissions. Composites are being used increasingly in the automotive industry due to their strength, quality and light weight. Advanced Composite Materials for Automotive Applications: Structural Integrity and Crashworthiness provides a comprehensive explanation of how advanced composite materials, including FRPs, reinforced thermoplastics, carbon-based composites and many others, are designed, processed and utilized in vehicles. It includes technical explanations of composite materials in vehicle design and analysis and covers all phases of composite design, modelling, testing and failure analysis. It also sheds light on the performance of existing materials including carbon composites and future developments in automotive material technology which work towards reducing the weight of the vehicle structure. Key

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features: Chapters written by world-renowned authors and experts in their own fields Includes detailed case studies and examples covering all aspects of composite materials and their application in the automotive industries Unique topic integration between the impact, crash, failure, damage, analysis and modelling of composites Presents the state of the art in composite materials and their application in the automotive industry Integrates theory and practice in the fields of composite materials and automotive engineering Considers energy efficiency and environmental implications Advanced Composite Materials for Automotive Applications: Structural Integrity and Crashworthiness is a comprehensive reference for those working with composite materials in both academia and industry, and is also a useful source of information for those considering using composites in automotive applications in the future.

Advanced Mechanics of Composite Materials and Structural Elements analyzes contemporary theoretical models at the micro- and macro levels of material structure. Its coverage of practical methods and approaches, experimental results, and optimization of composite material properties and structural component performance can be put to practical use by researchers and engineers. The third edition of the book consists of twelve chapters progressively covering all structural levels of composite materials from their constituents through elementary plies and layers to laminates and laminated composite structural elements. All-new coverage of beams, plates and shells adds significant currency to researchers. Composite materials have been the basis of many significant breakthroughs in industrial applications, particularly in aerospace structures, over the past forty years. Their high strength-to-weight and stiffness-to-weight ratios are the main material characteristics that attract the attention of the structural and design engineers. Advanced Mechanics of Composite Materials and Structural Elements helps ensure that researchers and engineers can continue to innovate in this vital field. Detailed physical and mathematical coverage of complex mechanics and analysis required in actual applications – not just standard homogeneous isotropic materials Environmental and manufacturing discussions enable practical implementation within manufacturing technology, experimental results, and design specifications. Discusses material behavior impacts in-depth such as nonlinear elasticity, plasticity, creep, structural nonlinearity enabling research and application of the special problems of material micro- and macro-mechanics

- Technical explanation of composite materials in vehicle design and manufacture
- Covers all phases of composites design, formulation, fabrication, and testing
- Features hundreds of case studies and hard-to-find formulas and analytical data
- Detailed information on resins, preforms, lightweighting, biobased materials

----- This technical book provides a comprehensive explanation of how advanced composite materials, including FRPs, reinforced thermoplastics, carbon-based composites and many others are designed, processed and utilized in exterior, interior, under-the-hood, structural, semi-structural and non-

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structural components in passenger cars, performance cars, trucks, motorbikes, and mass transit vehicles. The book clarifies how the material properties of composites can be optimized to decrease weight, expand design options, improve crashworthiness, and reduce fuel consumption in response to CAFE and other regulations. The many case studies and equation-based analyses in this book are intended to assist engineers and others in the selection of materials and the fabrication of vehicle parts.

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The automotive sector has taken a keen interest in lightweighting as new required performance standards for fuel economy come into place. This strategy includes parts consolidation, design optimization, and material substitution, with sustainable polymers playing a major role in reducing a vehicle's weight. Sustainable polymers are largely biodegradable, biocompatible, and sourced from renewable plant and agricultural stocks. A facile way to enhance their properties, so they can indeed replace the ones made from fossil fuels, is by reinforcing them with fibers to make composites. Natural fibers are gaining more acceptance in the industry due to their renewable nature, low cost, low density, low energy consumption, high specific strength and stiffness, CO₂ sequestration potential, biodegradability, and less wear imposed on machinery. Biocomposites then become a very feasible way to help address the fuel consumption challenge ahead of us. This book, entitled *Biocomposites in Automotive Applications*, is segmented into three sections and includes eleven hand-picked technical papers covering: Processing and characterization of biocomposites Automotive applications of biocomposites A perspective on automotive sustainability It is a must read for those interested in the growing importance of composites used in automotive applications and their impact on sustainable mobility.

- One of very few books available to cover this subject area.
- A practical book with a wealth of detail. This book covers the major manufacturing processes for polymer matrix composites with an emphasis on continuous fibre-reinforced composites. It covers the major fabrication processes in detail. Very few books cover the details of fabrication and assembly processes for composites. This book is intended for the engineer who wants to learn more about composite processing: any one with some experience in composites should be able to read it. The author, who has 34 years experience in the aerospace industry, has intentionally left out mathematical models for processes so the book will be readable by the general engineer. It differs from other books on composites manufacturing in focussing almost solely on manufacturing processes, while not attempting to cover materials, test methods, mechanical properties and other areas of composites.

Design of Automotive Composites reports that successful designs of automotive composites occurred recently in this arena. The chapters consist of eleven technical papers selected from the *Automotive Composites* and other relevant sessions that the editors have been organizing for the SAE International World Congress over the past five years.

This book deals with all aspects of advanced composite materials; what they are, where they are used, how they are made, their properties,

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how they are designed and analyzed, and how they perform in-service. It covers both continuous and discontinuous fiber composites fabricated from polymer, metal, and ceramic matrices, with an emphasis on continuous fiber polymer matrix composites.

Since the properties of MMCs can be directly designed "into" the material, they can fulfill all the demands set by design engineers. This book surveys the latest results and development possibilities for MMCs as engineering and functional materials, making it of utmost value to all materials scientists and engineers seeking in-depth background information on the potentials these materials have to offer in research, development and design engineering.

The last decade has seen a significant growth in the processing and fabrication of advanced composite materials. This volume contains the up-to-date contributions of those with working experience in the automotive, marine, aerospace and construction field. Starting with modern technologies concerned with assessing the change in material microstructure in terms of the processing parameters, methodologies are offered to account for tradeoffs between the fundamental variables such as temperature and pressure that control the product quality. The book contains new ideas and data, not available in the open literature.

Among the modern materials, the composites have a few decades of history. However, there has been a tremendous advancement of this class of material in science and technology. During recent decades, composite materials have steadily gained ground in nearly all sectors. The composite materials have been used in various industrial applications such as buildings and constructions, aerospace, automotive and sports equipment, consumer products etc. Nanotechnology is rapidly evolving, and science, engineering, and technology have merged to bring nanoscale materials that much closer to reality. It is one of the fastest growing areas for research. Nanocomposite materials are helping improve products that we use every day and creating new, exciting products for the future. Composites and nanocomposites composed of reinforcements, nano-reinforcements, and matrices are well-known engineering materials. Keeping in mind the advantages of composite and nanocomposite materials, this book covers fundamental effects, product development, properties, and applications of the materials including material chemistry, designing, and manufacturing. The book also summarizes the recent developments made in the area of advanced composite and nanocomposite materials. A number of critical issues and suggestions for future work are discussed, underscoring the roles of researchers for the efficient development of composites and nanocomposites through value additions to enhance their use.

Over much of the last three decades, the evolution of techniques for characterizing composite materials has struggled to keep up with the advances of composite materials themselves and their broadening areas of application. In recent years, however, much work has been done to consolidate test methods and better understand those being used. Finally,

This book presents an integrated approach to the design and manufacturing of products made of advanced composites. It is designed to teach students and practicing engineers how to streamline and improve the design process for parts and machines made out of composite materials by focusing on the behavior of composites and their constitutive relationships during the design stage. The primary market for this text will be industry-sponsored courses and practicing engineers, with some potential for use in university graduate courses in the US and abroad. The book will include a CD of the authors' own analytical software, Axiomatic CLPT (Classical Laminar Plate Theory) for students and self-learners. It is part of the Oxford Series on Advanced Manufacturing (OSAM).

The automotive industry is under constant pressure to design vehicles capable of meeting increasingly demanding challenges such as improved fuel economy, enhanced safety and effective emission control. Drawing on the knowledge of leading experts, Advanced materials in automotive engineering explores the development, potential and impact of using such materials. Beginning with a comprehensive introduction

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to advanced materials for vehicle lightweighting and automotive applications, Advanced materials in automotive engineering goes on to consider nanostructured steel for automotive body structures, aluminium sheet and high pressure die-cast aluminium alloys for automotive applications, magnesium alloys for lightweight powertrains and automotive bodies, and polymer and composite moulding technologies. The final chapters then consider a range of design and manufacturing issues that need to be addressed when working with advanced materials, including the design of advanced automotive body structures and closures, technologies for reducing noise, vibration and harshness, joining systems, and the recycling of automotive materials. With its distinguished editor and international team of contributors, Advanced materials in automotive engineering is an invaluable guide for all those involved in the engineering, design or analysis of motor vehicle bodies and components, as well as all students of automotive design and engineering. Explores the development, potential and impact of using advanced materials for improved fuel economy, enhanced safety and effective mission control in the automotive industry Provides a comprehensive introduction to advanced materials for vehicle lightweighting and automotive applications Covers a range of design ideas and manufacturing issues that arise when working with advanced materials, including technologies for reducing noise, vibration and harshness, and the recycling of automotive materials

*Research reports covering design, manufacturing and testing of advanced composite materials with military, civil engineering and transport applications Contains original research on composite materials in the following areas: aircraft, automotive, armor, crashworthiness, damage tolerance, micromechanics, molecular modeling, multifunctionality, structural health, textile composites and processing, as well as special presentations on aircraft, naval research, multiscale modeling and lightweight composites for cars.

Research into the manufacture of lightweight automobiles is driven by the need to reduce fuel consumption to preserve dwindling hydrocarbon resources without compromising other attributes such as safety, performance, recyclability and cost. Materials, design and manufacturing for lightweight vehicles will make it easier for engineers to not only learn about the materials being considered for lightweight automobiles, but also to compare their characteristics and properties. Part one discusses materials for lightweight automotive structures with chapters on advanced steels for lightweight automotive structures, aluminium alloys, magnesium alloys for lightweight powertrains and automotive structures, thermoplastics and thermoplastic matrix composites and thermoset matrix composites for lightweight automotive structures. Part two reviews manufacturing and design of lightweight automotive structures covering topics such as manufacturing processes for light alloys, joining for lightweight vehicles, recycling and lifecycle issues and crashworthiness design for lightweight vehicles. With its distinguished editor and renowned team of contributors, Materials, design and manufacturing for lightweight vehicles is a standard reference for practicing engineers involved in the design and material selection for motor vehicle bodies and components as well as material scientists, environmental scientists, policy makers, car companies and automotive component manufacturers. Provides a comprehensive analysis of the materials being used for the manufacture of lightweight vehicles whilst comparing characteristics and properties Examines crashworthiness design issues for lightweight vehicles and further emphasises the development of lightweight vehicles without compromising safety considerations and performance Explores the manufacturing process for light alloys including metal forming processes for automotive applications

Composite Materials in Aerospace Design is one of six titles in a coherent and definitive series dedicated to advanced composite materials research, development and usage in the former Soviet Union. Much of the information presented has been classified until recently. Thus each volume provides a unique insight into hitherto unknown research and development data. This volume deals with the design philosophy and

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methodology used to produce primary and secondary load bearing composite structures with high life expectancies. The underlying theme is of extensive advanced composites research and development programs in aircraft and spacecraft applications, including the space orbital ship `BURAN'. The applicability of much of this work to other market sectors, such as automotive, shipbuilding and sporting goods is also examined in some detail. The text starts by describing typical structures for which composites may be used in this area and some of the basic requirements from the materials being used. Design of components with composite materials is then discussed, with specific reference to case studies. This is followed by discussion and results from evaluation of finished structures and components, methods of joining with conventional materials and finally, non-destructive testing methods and forecasting of the performance of the composite materials and the structures which they form. Composite Materials in Aerospace Design will be of interest to anyone researching or developing in composite materials science and technology, as well as design and aerospace engineers, both in industry and universities.

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