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## 4F9 - EMELY CARTER

This book covers all aspects of physical vapor deposition (PVD) process technology from the characterizing and preparing the substrate material, through deposition processing and film characterization, to post-deposition processing. The emphasis of the book is on the aspects of the process flow that are critical to economical deposition of films that can meet the required performance specifications. The book covers subjects seldom treated in the literature: substrate characterization, adhesion, cleaning and the processing. The book also covers the widely discussed subjects of vacuum technology and the fundamentals of individual deposition processes. However, the author uniquely relates these topics to the practical issues that arise in PVD processing, such as contamination control and film growth effects, which are also rarely discussed in the literature. In bringing these subjects together in one book, the reader can understand the interrelationship between various aspects of the film deposition processing and the resulting film properties. The author draws upon his long experience with developing PVD processes and troubleshooting the processes in the manufacturing environment, to provide useful hints for not only avoiding problems, but also for solving problems when they arise. He uses actual experiences, called "war stories", to emphasize certain points. Special formatting of the text allows a reader who is already knowledgeable in the subject to scan through a section and find discussions that are of particular interest. The author has tried to make the subject index as useful as possible so that the reader can rapidly go to sections of particular interest. Extensive references allow the reader to pursue subjects in greater detail if desired. The book is intended to be both an introduction for those who are new to the field and a valuable resource to those already in the field. The discussion of transferring technology between R&D and manufacturing provided in Appendix 1, will be of special interest to the manager or engineer responsible for moving a PVD product and process from R&D into production. Appendix 2 has an extensive listing of periodical publications and professional societies that relate to PVD processing. The extensive Glossary of Terms and Acronyms provided in Appendix 3 will be of particular use to students and to those not fully conversant with the terminology of PVD processing or with the English language.

This book covers both basic scientific and clinically relevant aspects of dental composite materials with a view to meeting the needs of researchers and practitioners. Following an introduction on their development, the composition of contemporary composites is analyzed. A chapter on polymerization explains the setting reactions and light sources available for light-cured composites. The quality of monomer-to-polymer conversion is a key factor for material properties. Polymerization shrinkage along with the associated stress remains among the most challenging issues regarding composite restorations. A new classification of dental composites is proposed to offer more clinically relevant

ways of differentiating between commercially available materials. A review of specific types of composites provides an insight into their key issues. The potential biological issues of dental composites are reviewed in chapters on elution of leachable substances and cariogenicity of resin monomers. Clinical sections focus on material placement, finishing procedures, and the esthetics and clinical longevity of composite restorations. Bonding to tooth tissues is addressed in a separate chapter, as is the efficiency of various composite repair methods. The final chapter discusses future perspectives on dental composite materials.

In two volumes, this book provides comprehensive coverage of the fundamental knowledge and technology of composite materials. This second volume reviews the research developments of a number of widely studied composite materials with different matrices. It also describes the related process technology that is necessary for a successful production. This work is ideal for graduate students, researchers, and professionals in the fields of materials science and engineering, as well as mechanical engineering. Articles by 75 leading authorities cover virtually every aspect of composite materials and provide detailed information on methods of manufacturing properties, uses of composite materials and components. Entries include tables, figures, and extensive references. Alphabetical organization, cross-referencing, and a detailed index ensure easy access to all material. All of the contents have been taken from original material written for the Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., due to be completed Spring 1984.

This study deals with the problem of optimizing grain dispersed and fiber reinforced material structures. The optimization procedure is presented for the cases of the minimum weight and the maximum stiffness designs of structures. In these cases the design variables are volume percents of grain or fiber in several parts of structure and it is subjected to strength or volume constraint. The relations between the design variables and the mechanical properties of composite materials are very important to formulate the design problems.

An original mechanical formulation to treat nonlinear orthotropic behavior of composite materials is presented in this book. It also examines different formulations that allow us to evaluate the behavior of composite materials through the composition of its components, obtaining a new composite material. Also two multiple scale homogenization methods are given, one based on the analytical study of the cells (Ad-hoc homogenization) and other one, more general based on the finite element procedure applied on the macro scale (upper-scale) and in the micro scale (sub-scale). A very general formulation to simulate the mechanical behavior for traditional composite structures (plywood, reinforced concrete, masonry, etc.), as well as the new composite materials reinforced with long and short fibers, nanotubes, etc., are also shown in this work. Typical phenomena occurring in composite materials are also described in this work, including fiber-matrix debonding,

local buckling of fibers and its coupling with the overall buckling of the structure. Finally, several numerical examples that evaluate the qualities and capabilities of the general model formulated are offered in this book. This book is intended for graduate engineering students who want to expand their knowledge of composite structures behavior.

Preface; Enhancement of miscibility in multi-component solutions on the basis of three polymers and common solvents; Reinforcement of the Interface in Drawn Polymer Blends PS/PA-12; Quantum chemical calculation linear olefins and not conjugate diolefins; Technology computers search of new more effective catalysts cationic polymerisation olefins; Quantum chemical calculation and an estimation of acid force linear and ramified connected diens; Magnetic rectal suppositories for medical application: Investigation of their physical and chemical properties; Studying of a magnetic resonance in contrasting agents on the basis of biodecomposed magnetic fluids; Investigation of Micellisation at Non-ionic Surfactants in their solutions; Association of molecules and formation of micelles in solutions ionic surfactants; The interaction of surfactants with Ion Polymeric Sorbents; How the structure of sulphuryl amides influences the light stabilising properties; Of complex aerohydrodynamic research and the effectiveness of arresting dispersed particles for barbotage-rotation; The mechanism of selective oxidation of ethylbenzene with dioxygen into phenylethylhydroperoxide at catalysis by Fe(III)(acac)<sub>3</sub>, activated with additives of 18-crown-6 as ligand-modifier; Enhanced photo and thermal oxidative stability of charge-transfer complexes of conjugated polymers; Preparation and investigation of physical and chemical properties of ionic magnetic fluids on the basis of cobalt ferrite; Immunomagnetic separation of human hematopoietic cells: Physical -- chemical bases and medical -- biologic investigation; Emulsion polymerisation of (meth)acrylates: Characteristics of kinetics and mechanism; Behaviour of composite materials under micro-organisms of soil; New technologies for fast liquid-phase chemical processes; Index.

Hybrid Polymer Composite Materials: Applications provides a clear understanding of the present state-of-the-art and the growing utility of hybrid polymer composite materials. It includes contributions from world renowned experts and discusses the combination of different kinds of materials procured from diverse resources. In addition, this volume from the four volume series provides deep insights on the potential of hybrid polymer composite materials for advanced applications. Provides a clear understanding of the present state-of-the-art and the growing utility of hybrid polymer composite materials Includes contributions from world renowned experts and discusses the combination of different kinds of materials procured from diverse resources Discusses their synthesis, chemistry, processing, fundamental properties, and applications Provides insights on the potential of hybrid polymer composite materials for advanced applications

Focusing on all aspects of composites, this book covers the composition, structure, and physical properties of composites. You'll study the manufacturing methods of fiber reinforced plastics and post fabrication techniques, as well as the latest composites applications. Topics include: thermosets, thermoplastics, non-resinous matrices, reinforcements, fiber types, hybrids, physical properties of composites, design principles, environmental effects on composites, manufacturing and inspection techniques, and more.

Composites are a class of material, which receives much attention not only because it is on the cutting edge of active material research fields due to appearance of many new types of composites, e.g., nanocomposites and bio-medical composites, but also because there are a great deal of promises for their potential applications in various industries ranging from aerospace to con-

struction due to their various outstanding properties. This book mainly deals with fabrication and property characterization of various composites by focusing on the following topics: functional and structural nanocomposites, numerical and theoretical modelling of various damages in long fiber reinforced composites and textile composites, design, processing and manufacturing technologies and their effects on mechanical properties of composites, characterization of mechanical and physical properties of various composites, and metal and ceramic matrix composites. This book has been divided into five sections to cover the above contents.

Hierarchical Composite Materials provides an in-depth analysis of a class of advanced composites that have properties that are anisotropic due to structural organization at different length scales. Chapters address how ordering occurs from the atomic-scale up to the microstructure and how control of these factors leads to the final materials' properties. Manufacturing procedures, properties, and applications of different functionally graded materials are discussed in detail. This book is ideal for materials scientists, mechanical engineers, chemists and physicists.

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.

This compilation of abstracts describes and indexes over 780 technical reports resulting from the scientific and engineering work performed and managed by the Lewis Research Center in 1977. All the publications were announced in the 1977 issues of STAR (Scientific and Technical Aerospace Reports) and/or IAA (International Aerospace Abstracts). Documents cited include research reports, journal articles, conference presentations, patents and patent applications, and theses.

New technologies demand new materials. Polymer composites, with their wide range of possible fillers and polymers, open the way to an enormous range of materials with differing chemical, physical, and mechanical properties. The ultimate goal of polymer composite research is to formulate procedures that will lead to the design of composites with preset, i.e. specified, properties. Based on many years' experience in the field, the authors prepare the way towards just such a design procedure. The key element is the analysis and classification of the state of the filler-polymer interfaces from the point of view of their acid-base adsorption interactions. These interfacial phenomena play a pivotal role in determining overall properties of the composite: its rheological

behaviour, its structural properties, catalytic effects in polymerization and polycondensation, and other technological characteristics. The book discusses and evaluates the extensive previous research scattered throughout the literature in Eastern Europe and the West, presents numerous experimental studies, and sets new benchmarks for the analysis of polymer composites. The book is required for researchers wanting to keep abreast of the progress in the burgeoning fields of polymer analysis and design.

Nanocomposite coatings have various properties that can be utilized for corrosion protection and tribological improvements. Synthesis of the nanocomposite coatings using an electrodeposition method allows unique control of the experimental parameters. By fine tuning the experimental parameters, various compositions and properties can be obtained for the nanocomposite coatings. This book covers some of the electrochemical methods used for nanocomposite coating deposition as well as discusses in detail examples of several nanocomposite coating. The corrosion and tribological performance of the nanocomposite coatings are also covered and some nanocomposite coatings are discussed for specific technological areas, such as fuel cells and microelectronics.

Composite materials are used as substitutions of metals/traditional materials in aerospace, automotive, civil, mechanical and other industries. The present book collects the current knowledge and recent developments in the characterization and application of composite materials. To this purpose the volume describes the outstanding properties of this class of advanced material which recommend it for various industrial applications.

Concrete is a global material that underwrites commercial wellbeing and social development. There is no substitute that can be used on the same engineering scale and its sustainability, exploitation and further development are imperatives to creating and maintaining a healthy economy and environment worldwide. The pressure for change and improvement of performance is relentless and necessary. Concrete must keep evolving to satisfy the increasing demands of all its users.

Natural fiber-reinforced composites have the potential to replace synthetic composites, leading to less expensive, stronger and more environmentally-friendly materials. This book provides a detailed review on how a broad range of biofibers can be used as reinforcements in composites and assesses their overall performance. The book is divided into five major parts according to the origins of the different biofibers. Part I contains chapters on bast fibers, Part II; leaf fibers, Part III; seed fibers, Part IV; grass, reed and cane fibers, and finally Part V covers wood, cellulosic and other fibers including cellulosic nanofibers. Each chapter reviews a specific type of biofiber providing detailed information on the sources of each fiber, their cultivation, how to process and prepare them, and how to integrate them into composite materials. The chapters outline current and potential applications for each fiber and discuss their main strengths and weaknesses. The book is divided into five major parts according to the origins of the different biofibers - bast, leaf, seed; grass, reed and cane fibers, and finally wood, cellulosic and other fibers including cellulosic nanofibers. This book provides a detailed review on how a broad range of biofibers can be used as reinforcements in composites and assesses their overall performance. The chapters outline current and potential applications for each fiber and discuss their main strengths and weaknesses.

This volume focuses on quasilinear elliptic differential equations of degenerate type, evolution variational inequalities, and multidimensional hysteresis. It serves both as a survey of results in the field, and as an introductory text for non-specialists interested in related problems.

This book deals with all aspects of advanced composite materials;

what they are, where they are used, how they are made, their properties, 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.

Volume is indexed by Thomson Reuters BCI (WoS). Composite materials are increasingly finding use in diverse applications requiring a wide range of property and performance requirements. Low density, high specific strength and stiffness are the main features that make composite materials most suitable for structural applications. The field covers the concurrent manipulation of the material's composition and of the internal architecture of the composite in order to obtain the desired properties. The ability to tailor composite materials precisely is of great importance in structural applications. A systematic approach to the optimum tailoring of composite materials is a challenging design problem. The focus should be on the practical design aspects, and that is what is addressed in this special-topic volume.

This edition has been greatly enlarged and updated to provide both scientists and engineers with a clear and comprehensive understanding of composite materials. In describing both theoretical and practical aspects of their production, properties and usage, the book crosses the borders of many disciplines. Topics covered include: fibres, matrices, laminates and interfaces; elastic deformation, stress and strain, strength, fatigue crack propagation and creep resistance; toughness and thermal properties; fatigue and deterioration under environmental conditions; fabrication and applications. Coverage has been increased to include polymeric, metallic and ceramic matrices and reinforcement in the form of long fibres, short fibres and particles. Designed primarily as a teaching text for final-year undergraduates in materials science and engineering, this book will also interest undergraduates and postgraduates in chemistry, physics, and mechanical engineering. In addition, it will be an excellent source book for academic and technological researchers on materials.

Fiber-reinforced polymer (FRP) composites have become an integral part of the construction industry because of their versatility, enhanced durability and resistance to fatigue and corrosion, high strength-to-weight ratio, accelerated construction, and lower maintenance and life-cycle costs. Advanced FRP composite materials are also emerging for a wide range of civil infrastructure applications. These include everything from bridge decks, bridge strengthening and repairs, and seismic retrofit to marine waterfront structures and sustainable, energy-efficient housing. The International Handbook of FRP Composites in Civil Engineering brings together a wealth of information on advances in materials, techniques, practices, nondestructive testing, and structural health monitoring of FRP composites, specifically for civil infrastructure. With a focus on professional applications, the handbook supplies design guidelines and standards of practice from around the world. It also includes helpful design formulas, tables, and charts to provide immediate answers to common questions. Organized into seven parts, the handbook covers: FRP fundamentals, including history, codes and standards, manufacturing, materials, mechanics, and life-cycle costs Bridge deck applications and the critical topic of connection design for FRP structural members External reinforcement for rehabilitation, including the strengthening of reinforced concrete, masonry, wood, and metallic structures FRP composites for the reinforcement of concrete structures, including material characteristics, design procedures, and quality assurance-quality control (QA/QC) issues Hybrid FRP composite systems, with an emphasis on design, construction, QA/QC, and repair Quality control, quality assurance, and evalua-

tion using nondestructive testing, and in-service monitoring using structural health monitoring of FRP composites, including smart composites that can actively sense and respond to the environment and internal states FRP-related books, journals, conference proceedings, organizations, and research sources Comprehensive yet concise, this is an invaluable reference for practicing engineers and construction professionals, as well as researchers and students. It offers ready-to-use information on how FRP composites can be more effectively utilized in new construction, repair and reconstruction, and architectural engineering.

Helping students prepare for the Edexcel assessment in graphic products, this revision text offers advice and guidance on what examiners are looking for, focuses on the application of knowledge to industry to build confidence and summarizes key information.

This book is the first to deal with the important topic of the fire behaviour of fibre reinforced polymer composite materials. The book covers all of the key issues on the behaviour of composites in a fire. Also covered are fire protection materials for composites, fire properties of nanocomposites, fire safety regulations and standards, fire test methods, and health hazards from burning composites.

In this chapter, the characterisation of the halloysite nanotubes (HNTs) and multiwalled carbon nanotubes (MWCNTs) as the reinforcement in the composite materials was described. The original and author technology of production of the aluminium AlMg1SiCu matrix composite materials reinforced with halloysite or carbon nanotubes using powder metallurgy techniques, including mechanical alloying and hot extrusion and the range of own research in the case to determine microstructure, as well as mechanical properties of those materials was present. It was investigated that the addition of carbon and halloysite nanotubes causes a significant improvement in mechanical properties of the obtained nanocomposites. The investigation results show that the technology used in manufacturing nanocomposite materials can find the practical application in the production of new light metal matrix nanocomposites.

Artificial neural networks (ANN) can provide new insight into the study of composite materials and can normally be combined with other artificial intelligence tools such as expert system, genetic algorithm, and fuzzy logic. Because research on this field is very new, there is only a limited amount of published literature on the subject. Compiling information from diverse sources, *Composite Materials Technology: Neural Network Applications* fills the void in knowledge of these important networks, covering composite mechanics, materials characterization, product design, and other important aspects of polymer matrix composites. Light weight, corrosion resistance, good stiffness and strength properties, and part consolidation are just some of the reasons that composites are useful in areas including civil engineering and structure, chemical processing, management, agriculture, space study, and manufacturing. ANN has already been used to carry out design prediction, mechanical property prediction, and selection processes in the evolution of composites, but although it has already been used with great success in various branches of scientific and technological research, it is still in the nascent stage of its development. Featuring contributions from leading researchers throughout the world, this book is divided into four parts, starting with an introduction to neural networks and a review of existing literature on the subject. The text then covers structural health monitoring and damage detection in composites, addresses mechanical properties, and discusses design, analysis, and materials selection. Training, testing, and validation of experimental data were carried out to optimize the results presented in the book. This book will be an important aid to researchers as they work on the future

implementation of ANN in industries such as aerospace, automotive, marine, sporting goods, furniture, and electronics and communication.

*Nanobiomaterials in Clinical Dentistry, Second Edition* shows how a variety of nanomaterials are being used to solve problems in clinical dentistry. New nanomaterials are leading to a range of emerging dental treatments that utilize more biomimetic materials that more closely duplicate natural tooth structure (or bone, in the case of implants). The book's chapters discuss the advantages and challenges of using nanomaterials and include case studies to illustrate how a variety of materials are best used in research and practice. Contains information from an interdisciplinary, international group of scientists and practitioners in the fields of nanomaterials, dental implants, medical devices and clinical practice Presents a comprehensive reference on the subject that covers material fabrication and the use of materials for all major diagnostic and therapeutic dental applications--repair, restoration, regeneration, implants and prevention Complements the editors' previous book on nanotechnology applications for dentistry

*Cement-Based Composites* takes a different approach from most other books in the field by viewing concrete as an advanced composite material, and by considering the properties and behaviour of cement-based materials from this stance. It deals particularly, but not exclusively, with newer forms of cement-based materials. This new edition takes a critical approach to the subject as well as presenting up-to-date knowledge. Emphasis is given to non-conventional reinforcement and design methods, problems at the materials' interfaces and to the durability of structures. High strength composites and novel forms of cement-based composites are described in detail. After a basic introduction the book explores the various components of these materials and their properties. It then deals with mechanical properties and considers characteristics under various loading and environmental conditions, and concludes by examining design, optimization and economics with particular emphasis on high-performance concretes. Researchers, graduate students and practising engineers will find this book valuable.

Updated and improved, *Stress Analysis of Fiber-Reinforced Composite Materials*, Hyer's work remains the definitive introduction to the use of mechanics to understand stresses in composites caused by deformations, loading, and temperature changes. In contrast to a materials science approach, Hyer emphasizes the micromechanics of stress and deformation for composite material analysis. The book provides invaluable analytic tools for students and engineers seeking to understand composite properties and failure limits. A key feature is a series of analytic problems continuing throughout the text, starting from relatively simple problems, which are built up step-by-step with accompanying calculations. The problem series uses the same material properties, so the impact of the elastic and thermal expansion properties for a single-layer of FR material on the stress, strains, elastic properties, thermal expansion and failure stress of cross-ply and angle-ply symmetric and unsymmetric laminates can be evaluated. The book shows how thermally induced stresses and strains due to curing, add to or subtract from those due to applied loads. Another important element, and one unique to this book, is an emphasis on the difference between specifying the applied loads, i.e., force and moment results, often the case in practice, versus specifying strains and curvatures and determining the subsequent stresses and force and moment results. This represents a fundamental distinction in solid mechanics.

Biom mineralization is a natural process by which living organisms form minerals in association with organic biostructures to form hy-

brid biological materials such as bone, enamel, dentine and nacre among others. Scientists have researched the fundamentals of these processes and the unique structures and properties of the resulting mineralized tissues. Inspired by them, new biomaterials for tissue engineering and regenerative medicine have been developed in recent years. *Biomineralization and biomaterials: fundamentals and applications* looks at the characteristics of these essential processes and natural materials and describes strategies and technologies to biomimetically design and produce biomaterials with improved biological performance. Provides a thorough overview of the biomineralization process Presents the most recent information on the natural process by which crystals in tissues form into inorganic structures such as bone, teeth, and other natural mineralized tissues Investigates methods for improving mineralization Explores new techniques that will help improve the biomimetic process

The bibliography contains over 3000 references, including translated items from Japan, West Germany, U.S.S.R., and other countries as well as references of original English language publications of the United States and United Kingdom. The references are categorized by specific fiber and matrix materials. In addition, many references are grouped in the general categories of compatibility studies, theory and design, testing and evaluation, application, and fabrication. A group of references to general review articles is included. The references represent the holdings of the former Defense Ceramic Information Center (DCIC) plus those of the Fibers and Composites Center (FCIC) at Battelle's Columbus Laboratories and MCIC. (Author).

Responding to the need for a single reference source on the design and applications of composites, *Composite Materials: Design and Applications, Second Edition* provides an authoritative examination of the composite materials used in current industrial applications and delivers much needed practical guidance to those working in this rapidly d

The composite material is made up of the combination of two or more constituent materials that have distinct chemical and physical properties. When two different materials are combined they often produce a material that has different characteristics from ei-

ther of the individual components. Each component remains separate within the finished structure. There are two categories of these constituent materials, matrix and reinforcement. The matrix material is used to support and surround the reinforcement materials by maintaining their relative positions. The reinforcements enhance the matrix properties by their special mechanical and physical properties. At least one portion of each constituent material should be added in the composition. Composite materials are lighter, stronger and less expensive than the traditionally used materials. They are often used in the construction of bridges, buildings, and other structures such as boat hulls and racing car bodies. This book is a valuable compilation of topics, ranging from the basic to the most complex advancements in the field of composite materials. Most of the topics introduced in it cover new techniques and applications of such materials. It is appropriate for students seeking detailed information in this area as well as for ex

*Advanced Dental Biomaterials* is an invaluable reference for researchers and clinicians within the biomedical industry and academia. The book can be used by both an experienced researcher/clinician learning about other biomaterials or applications that may be applicable to their current research or as a guide for a new entrant into the field who needs to gain an understanding of the primary challenges, opportunities, most relevant biomaterials, and key applications in dentistry. Provides a comprehensive review of the materials science, engineering principles and recent advances in dental biomaterials Reviews the fundamentals of dental biomaterials and examines advanced materials' applications for tissues regeneration and clinical dentistry Written by an international collaborative team of materials scientists, biomedical engineers, oral biologists and dental clinicians in order to provide a balanced perspective on the field

*Composite Materials and Processing* provides the science and technology of processing several composites using different processing methods, and includes collective information on the processing of common and advanced composite materials. It also weighs the advantages and disadvantages of various processing methods. This book is suitable for materia