

Functional Materials

Electrical, Dielectric, Electromagnetic, Optical and Magnetic Applications

Engineering Materials for Technological Needs - Vol. 2

FUNCTIONAL MATERIALS: Electrical, Dielectric, Electromagnetic, Optical and Magnetic Applications (With Companion Solution Manual)

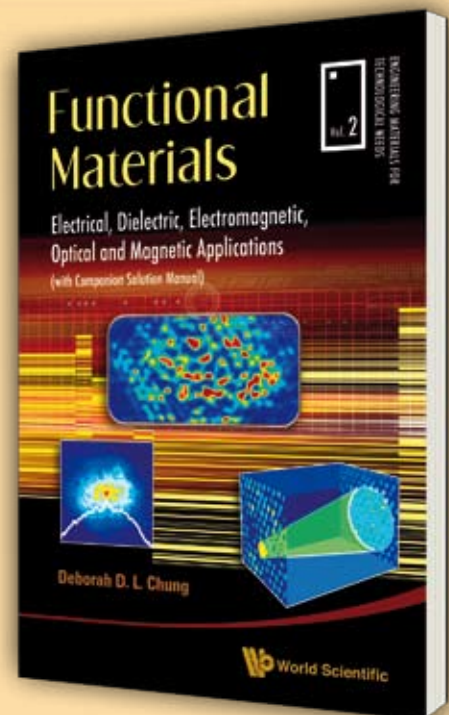
by **Deborah D L Chung** (*State University of New York at Buffalo, USA*)

The development of functional materials is at the heart of technological needs and the forefront of materials research. This book provides a comprehensive and up-to-date treatment of functional materials, which are needed for electrical, dielectric, electromagnetic, optical, and magnetic applications. Materials concepts covered are strongly linked to applications. Textbooks related to functional materials have not kept pace with technological needs and associated scientific advances. Introductory materials science textbooks merely gloss over functional materials while electronic materials textbooks focus on semiconductors and smart materials textbooks emphasize more on limited properties that pertain to structures.

Functional Materials assumes that the readers have had a one-semester introductory undergraduate course on materials science. The coverage on functional materials is much broader and deeper than that of an introductory materials science course. The book features hundreds of illustrations to help explain concepts and provide quantitative information. The style is general towards tutorial. Most chapters include sections on example problems, review questions and supplementary reading. This book is suitable for use as a textbook in undergraduate and graduate engineering courses. It is also suitable for use as a reference book for professionals in the electronic, computer, communication, aerospace, automotive, transportation, construction, energy and control industries.

Contents: Introduction to Functional Materials and Their Applications; Electrical Conduction Behavior; Dielectric Behavior; Electromagnetic Behavior; Optical Behavior; Magnetic Behavior.

Readership: Undergraduate students, graduate students and professionals in most branches of engineering, specifically materials, electrical, mechanical, aerospace, chemical and civil engineering. Relevant professionals include engineers, scientists, researchers, technicians and technology managers.



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AN INTRODUCTION TO ELECTRONIC MATERIALS FOR ENGINEERS

(2nd Edition)

by **Wei Gao, Zhengwei Li** (University of Auckland, New Zealand) & **Nigel Sammes** (Colorado School of Mines, USA)

An Introduction to Electronic Materials for Engineers aims to give a basic understanding and comprehensive overview of a wide range of materials, such as conducting materials, semiconductors, magnetic materials, optical materials, dielectric materials, superconductors, thermoelectric materials and ionic materials. The new chapters added into this latest edition include thin film electronic materials, organic electronic materials and nanostructured materials. These chapters aim to reflect the new developments made in electronic materials and nanotechnology research towards the design and fabrication of modern equipment and electronic devices.

Contents: Classical Theory of Electrical Conduction and Conducting Materials; Electron Energy in Solids; Electron Emission; Semiconductor: Properties and Materials; Magnetic Properties and Materials; Dielectric Materials; Optical Properties and Materials; Thermal and Thermoelectric Properties; Superconductors; Thin Film Electronic Materials; Organic Electronic Materials; Ionic Materials and Properties; Nanomaterials for Electronic Devices Applications.

Readership: Students, professionals (engineering), non-experts interested in electronic materials.

450pp (approx.)	Scheduled Summer 2010	
978-981-4293-69-3	US\$68	£51
978-981-4293-71-6(ebk)	US\$88	

MATERIALS DEGRADATION AND ITS CONTROL BY SURFACE ENGINEERING (3rd Edition)

by **Andrew Batchelor** (Aramco, Saudi Arabia) , **Margam Chandrasekaran** (Bio-Scaffold International Pte Ltd, Singapore) , & **Nee Lam Loh** (Nanyang Technological University, Singapore)

This book provides a general holistic view of materials degradation without undue emphasis on aqueous corrosion with the neglect of other important topics such as liquid metal corrosion. Discussion of materials degradation is balanced by detailed description and evaluation of surface engineering as a means of managing materials degradation. Thus, the trainee engineer is presented with a comprehensive view of the problem rather than just a part of the problem. The control or management of materials degradation is not only discussed in scientific terms, but the economics or financial aspects of materials degradation and surface engineering is also discussed in detail with the help of analytical models.

Contents: Mechanisms of Materials Degradation:Mechanical Causes of Materials Degradation;Chemical Causes of Materials Degradation;Materials Degradation Induced by Heat and Other Forms of Energy;Duplex Causes of Materials Degradation;; **Surface Engineering:**Discrete Coatings Integral Coatings and Modified Surface Layers;Characterization of Surface Coatings;; **Application of Control Techniques:**Control of Materials Degradation;Financial and Industrial Aspects of Materials Degradation and Its Control;.

Readership: Engineers and scientists in materials engineering, surface science, materials science (general), materials chemistry and surface and interface chemistry.

450pp	Jul 2010	
978-1-84816-501-4	US\$138	£104
978-1-84816-502-1(ebk)	US\$179	

POLYMER MEMBRANES IN BIOTECHNOLOGY: Preparation, Functionalization and Application

by **Seeram Ramakrishna** (National University of Singapore, Singapore) , **Zuwei Ma** (National University of Singapore, Singapore) , & **Takeshi Matsuura** (University of Ottawa, Canada)

This book provides a concise and comprehensive introduction of polymer membranes' preparation, functionalization and applications in biotechniques including affinity membrane chromatography, membrane-based biosensor and membrane-based bioreactor. Following an introduction to the general concept of membrane separation in Chapter 1, preparation of polymeric membranes is discussed in Chapter 2. The book then describes in Chapter 3 membrane surface activation, which is a key step in ligand immobilizations. Chapter 4 focuses on ligand immobilization techniques and the organic chemistries behind them. Chapter 5 introduces the application of affinity membrane chromatography. Finally, in Chapter 6, membranes used in biosensors and gas sensors, enzymatic membranes used as biosensor, and membrane biosensor for waste water treatment will be discussed. A novel filter medium, i.e. nonwoven nanofiber membrane, and its preparation method, i.e. electrospinning technique, are also introduced in this book.

Contents: Membrane and Membrane Separation Process; Membrane Preparation; Surface Modification of Polymers; Immobilization of Functional Molecules and the Chemistry; Membrane Chromatography; Membranes in Biosensors and Bioreactors.

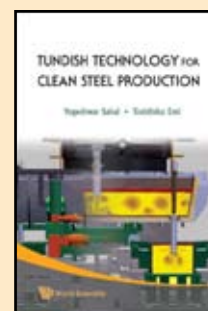
Readership: Undergraduates, graduates and researchers in membrane science, polymer membrane preparation, affinity membrane chromatography and theories, polymer surface modification and enzyme functionalized membrane.

300pp	Feb 2010	
978-1-84816-379-9	US\$75	£56
978-1-84816-380-5(pbk)	US\$45	£34
978-1-84816-381-2(ebk)	US\$98	

TUNDISH TECHNOLOGY FOR CLEAN STEEL PRODUCTION

by **Yogeshwar Sahai** (The Ohio State University, USA) & **Toshihiko Emi** (Institute of Research of Iron & Steel, Jiangsu/Shi-Steel, China)

Continuous casting of steel has become a widely used process and an important step in steel production. The worldwide share of continuously cast steel has increased significantly in the last 25 years or so. However, concurrent with this increase in production levels are stringent quality requirements that have become crucial in the face of progressively increasing machine throughputs and larger product dimensions. As a result, steel cleanliness and strict composition control are now the primary concern of steelmakers. The tundish is the last metallurgical vessel through which molten metal flows before solidifying in the continuous casting mold. During the transfer of metal through the tundish, molten steel interacts with refractories, slag, and the atmosphere. Thus, the proper design and operation of a tundish are important for delivering steel of strict composition and quality. This pioneering book is the first of its kind to cover all aspects of tundish technology, ranging from fundamental aspects and theory necessary for understanding the basic concepts of tundish operations to operational aspects of the tundish.



Contents: Non-Metallic Inclusions; Review of Fluid Flow and Turbulence; Fluid Flow Characterization; Modeling of Melt Flow; Tundish Operation; Melt Temperature Control; Recent, Emerging, and Novel Technologies.

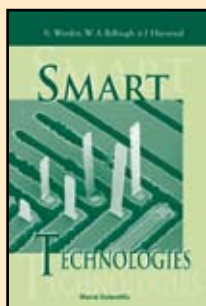
Readership: Undergraduate and graduate students in process metallurgy as well as researchers in steel and metallurgical production.

328pp	Dec 2007	
978-981-270-621-8	US\$98	£53
978-981-279-076-7(ebk)	US\$127	

SMART TECHNOLOGIES

edited by **K Worden** (University of Sheffield, UK), **W A Bullough** (University of Sheffield, UK), & **J Haywood** (University of Sheffield, UK)

"All contributions are presented in a simple and non-mathematical approach. This book is particularly suited to scientists who are already involved in one sector of smart technologies and would like to broaden their knowledge or are willing to expand their activities to another field. Also, because of the simple approach used to introduce the various topics and the large number of examples presented it could be of great help for Masters or PhD students who are beginning their projects in their field." **Journal of Sound and Vibration**



Contents: The Smart Approach — An Introduction to Smart Technologies; Sensing Systems for Smart Structures; Vibration Control Using Smart Structures; Data Fusion — The Role of Signal Processing for Smart Structures and Systems; Shape Memory Alloys — A Smart Technology?; Piezoelectric Materials; Magnetostriction; Smart Fluid Machines; Smart Biomaterials — "Out-Smarting" the Body's Defence Systems and Other Advances in Materials for Medicine; Natural Engineering — The Smart Synergy.

Readership: Undergraduates and researchers in materials science and engineering, electrical & electronic engineering, systems engineering and aerospace engineering.

284pp **Apr 2003**
978-981-02-4776-8 **US\$100** **£75**
978-981-270-531-0(ebk) **US\$130**

CRYSTAL GROWTH FOR BEGINNERS **Fundamentals of Nucleation, Crystal Growth and Epitaxy (2nd Edition)**

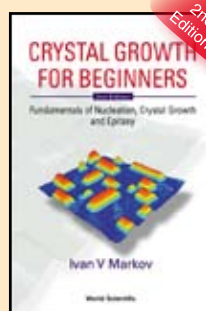
by **Ivan V Markov** (Bulgarian Academy of Sciences, Bulgaria)

This is the first-ever textbook on the fundamentals of nucleation, crystal growth and epitaxy. It has been written from a unified point of view and is thus a non-eclectic presentation of this interdisciplinary topic in materials science. The reader is required to possess some basic knowledge of mathematics and physics. All formulae and equations are accompanied by examples that are of technological importance. The book presents not only the fundamentals but also the state of the art in the subject. The second revised edition includes two separate chapters dealing with the effect of the Ehrlich-Schwoebel barrier for down-step diffusion, as well as the effect of surface active species, on the morphology of the growing surfaces. In addition, many other chapters are updated accordingly.

Contents: Crystal — Ambient Phase Equilibrium; Nucleation; Crystal Growth; Epitaxial Growth.

Readership: Graduate students, academics and researchers in materials engineering, microelectronics, new materials, semiconductors and related areas.

564pp **Aug 2003**
978-981-238-245-0 **US\$120** **£86**
978-981-279-689-9(ebk) **US\$156**



Series on Advances in Mathematics for Applied Sciences - Vol. 55

MESOMECHANICAL CONSTITUTIVE MODELING

by **V Kafka** (Academy of Sciences, Czech Republic)

"This carefully written book, based to a large degree on original and new research, is an essential source of information for anyone dealing with property modeling aspects in modern materials science. It can be warmly recommended for graduate students and researchers in the respective fields." **Ceramics — Silikaty**

Contents: General Mesomechanical Model of Heterogeneous, Statistically Homogeneous Materials; Models of Materials with Statistically Isotropic Structure; Plasticity of Polycrystalline Metals; Time-Dependent Deformation; Fracturing; Shape Memory; Transversely Isotropic Materials.

Readership: Researchers in the mechanics of materials, mechanical engineering, civil engineering and applied mathematics.

240pp **Dec 2000**
978-981-02-4485-9 **US\$65** **£45**
978-981-279-182-5(ebk) **US\$85**

INNOVATIVE PROCESSING OF FILMS AND NANOCRYSTALLINE POWDERS

edited by **Kwang-Leong Choy** (Imperial College, UK)

This book highlights innovative/cost-effective material-processing methods, at a mature production stage and also in development. In addition, issues and strategies associated with scaling-up are emphasized.

Contents: Review of Advances in Processing Methods: Films and Nanocrystalline Powders (*K-L Choy*); Process Principles and Applications of Novel and Cost-Effective ESAVD Based Methods (*K-L Choy*); Application of Pulsed Injection MOCVD to the Deposition of Oxide Single Layers and Superlattices (*J-P Sénateur et al.*); amongst others.

Readership: Materials scientists and engineers in industry and R&D institutes.

308pp **Oct 2002**
978-1-86094-316-4 **US\$95** **£72**
978-1-86094-962-3(ebk) **US\$124**

Materials for Engineering

CRYSTALLINE MATERIALS FOR ACTINIDE IMMOBILISATION

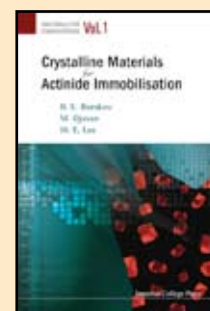
by **Boris E Burakov** (V G Khlopin Radium Institute, Russia), **Michael I Ojovan** (University of Sheffield, UK), & **Willian (Bill) E Lee** (Imperial College, UK)

This book summarises approaches and current practices in actinide immobilisation using chemically-durable crystalline materials e.g. ceramics and monocrystals. Durable actinide-containing materials including crystalline ceramics and single crystals are attractive for various applications such as nuclear fuel to burn excess Pu, chemically inert sources of α irradiation for use in unmanned space vehicles or producing electricity for microelectronic devices, and nuclear waste disposal. Long-lived α -emitting actinides such as Pu, Np, Am and Cm are currently of serious concern has a result of increased worldwide growth in the nuclear industry.

Contents: Physical and Chemical Properties of Actinides; Areas of Actinide Use; Nuclear Waste Immobilisation of Actinides; Synthesis of Chemically Durable Actinides; Analytical Methods for Actinide; Future Potential of Actinide Containing Materials.

Readership: Undergraduates, post-graduates, researchers and specialists studying physics, chemistry, geology and environmental engineering with an interest in the welfare of planet.

400pp **Oct 2010**
978-1-84816-418-5 **US\$128** **£96**
978-1-84816-419-2(ebk) **US\$166**



INTERFACES FOR THE 21ST CENTURY: NEW RESEARCH DIRECTIONS IN FLUID MECHANICS AND MATERIALS SCIENCE

edited by **Marc K Smith** (*Georgia Institute of Technology, USA*), **Michael J Miksis** (*Northwestern University, USA*), **Geoffrey B McFadden** (*National Institute of Standards and Technology, USA*), **G Paul Neitzel** (*Georgia Institute of Technology, USA*), & **David R Canright** (*Naval Postgraduate School, USA*)

This book highlights some recent advances in interfacial research in the fields of fluid mechanics and materials science at the beginning of the twenty-first century. It is an extension of the presentations made during the conference "Interfaces for the 21st Century," held on August 16–18, 1999, in Monterey, California. It includes papers by sixteen renowned experts in the field of interfacial mechanics, abstracts contributed by research scientists, and a summary of a panel discussion on future research directions. The book covers experimental and theoretical approaches, with the unifying philosophy being the investigation of new techniques for modeling the dynamics of interfaces. A number of new and exciting solution methods and experimental studies, as well as the physical problems that initiated them, are presented.



Contents: The Effect of a Stabilising Gradient on Interface Morphology (*T Maxworthy*); Spreading of a Liquid Drop with Mass Loss (*L M Hocking*); Viscous Gravity Currents with Solidification (*M Bunk et al.*); Coarsening Dynamics of Roll Waves (*H-C Chang & E A Demekhin*); Thermocapillary Control with Feedback of Large Wavelength Interfacial Instabilities (*R E Kelly*); Pattern Formation in Thin Liquid Films (*D Gallez & E R de Souza*); Molecular Aspects of Contact-Line Dynamics (*J Koplík & J R Banavar*); Computational Methods for Advancing Interfaces (*J A Sethian*); Direct Numerical Simulations of Multiphase Flows (*G Tryggvason & B Bunner*); and other papers.

Readership: Researchers and graduate students in fluid mechanics and materials science.

332pp **May 2002**
978-1-86094-319-5 **US\$83** **£63**
978-1-86094-960-9(ebk) **US\$108**

About FML: Aims & Scope

Functional Materials Letters is an international peer-reviewed scientific journal for original contributions to research on the synthesis, behavior and characterization of functional materials. The journal seeks to provide a rapid forum for the communication of novel research of high quality and with an interdisciplinary flavor. The journal is an ideal forum for communication amongst materials scientists and engineers, chemists and chemical engineers, and physicists in the dynamic fields associated with functional materials.

Functional materials are designed to make use of their natural or engineered functionalities to respond to changes in electrical and magnetic fields, physical and chemical environment, etc. These design considerations are fundamentally different to those relevant for structural materials and are the focus of this journal. Functional materials play an increasingly important role in the development of the field of materials science and engineering.

The scope of the journal covers theoretical and experimental studies of functional materials, characterization and new applications-related research on functional materials in macro-, micro- and nano-scale science and engineering. Among the topics covered are ferroelectric, multiferroic, ferromagnetic, magneto-optical, optoelectric, thermoelectric, energy conversion and energy storage, sustainable energy and shape memory materials.

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