

Structural Ceramics Fundamentals And Case Studies

This book covers the area of advanced ceramic composites broadly, providing important introductory chapters to fundamentals, processing, and applications of advanced ceramic composites. Within each section, specific topics covered highlight the state of the art research within one of the above sections. The organization of the book is designed to provide easy understanding by students as well as professionals interested in advanced ceramic composites. The various sections discuss fundamentals of nature and characteristics of ceramics, processing of ceramics, processing and properties of toughened ceramics, high temperature ceramics, nanoceramics and nanoceramic composites, and bioceramics and biocomposites.

Fundamentals of Ceramics presents readers with an exceptionally clear and comprehensive introduction to ceramic science. This Second Edition updates problems and adds more worked examples, as well as adding new chapter sections on Computational Materials Science and Case Studies. The Computational Materials Science sections describe how today density functional theory and molecular dynamics calculations can shed valuable light on properties, especially ones that are not easy to measure or visualize otherwise such as surface energies, elastic constants, point defect energies, phonon modes, etc. The Case Studies sections focus more on applications, such as solid oxide fuel cells, optical fibers, alumina forming materials, ultra-strong and thin glasses, glass-ceramics, strong and tough ceramics, fiber-reinforced ceramic matrix composites, thermal barrier coatings, the space shuttle tiles, electrochemical impedance spectroscopy, two-dimensional solids, field-assisted and microwave sintering, colossal magnetoresistance, among others.

This book explores, in a systematic way, both conventional and unconventional material shaping processes with various modes of hybridization in relation to theory, modelling and industrial potential. The demand for high productivity and high accuracy in manufacturing is continuously increasing, based on improvement and optimization strategies. Hybridization of manufacturing processes will play a crucial role and will be of a key importance in achieving environmental and economical sustainability. Structured in three parts, Hybrid Manufacturing Processes summarizes the state-of-the-art hybrid manufacturing processes based on available literature sources and production reports. The book begins by providing information on the physical fundamentals of the removal and non-removal processes in macro-, micro and nanoscales. It then follows with an overview of the possible ways of hybridization and the effects on the enhancement of process performance, before concluding with a summary of production outputs related to surface integrity, specifically with respect to difficult-to-machine materials. Considering the applications of different sources of hybridization including mechanical, thermal and chemical interactions or their combinations, this book will be of interest to a range of researchers and practicing engineers within the field of manufacturing.

This book discusses fundamentals of nanostructured ceramics involving functional, structural and high temperature materials. It provides both solved numerical problems and unsolved problems to enable the reader to envisage the correlation between synthesis process and properties in the perspective of new material development. It serves as a concise text to answer the basics and achieve research goals for academia and industry. Key Features Deals with basic strategy on data interpretation for nanostructured ceramics Proposes to bridge the gap between the nano and bulk properties of nanostructured ceramics Discusses brief schematics and equations to understand the different properties of nano to bulk ceramics Presents mode of data acquisition and interpretation through statistical module and solved numerical Includes unsolved numericals based on properties, data acquisition and interpretation

Structural Ceramics

Tribology of Ceramics and Composites

Technical Ceramics and Glasses

Advanced Structural Ceramics

Encyclopedia of Materials

Friction and Wear of Ceramics

Reviews production methods, microstructures, and properties of structural ceramics with important applications, including high voltage insulators, hot gas filters, machining tools, and hip joint replacements.

Proceedings containing 231 manuscripts that were submitted and approved for the 13th biennial worldwide refractories congress recognized as the United International Technical Conference on Refractories(UNITECR), held September 10-13, 2013.

A Comprehensive and Self-Contained Treatment of the Theory and Practical Applications of Ceramic Materials When failure occurs in ceramic materials, it is often catastrophic, instantaneous, and total. Now in its Second Edition, this important book arms readers with a thorough and accurate understanding of the causes of these failures and how to design ceramics for failure avoidance. It systematically covers: Stress and strain Types of mechanical behavior Strength of defect-free solids Linear elastic fracture mechanics Measurements of elasticity, strength, and fracture toughness Subcritical crack propagation Toughening mechanisms in ceramics Effects of microstructure on toughness and strength Cyclic fatigue of ceramics Thermal stress and thermal shock in ceramics Fractography Dislocation and plastic deformation in ceramics Creep and superplasticity of ceramics Creep rupture at high temperatures and safe life design Hardness and wear And more While maintaining the first edition's reputation for being an indispensable professional resource, this new edition has been updated with sketches, explanations, figures, tables, summaries, and problem sets to make it more student-friendly as a textbook in undergraduate and graduate courses on the mechanical properties of ceramics.

Ceramics, Powders, Corrosion and Advanced Processing covers the proceedings of the Third International Union of Materials Research Societies (IUMRS) International Conference on Advanced Materials (ICAM), held in Sunshine City, Ikebukuro, Tokyo, Japan from August 31 to September 4, 1993. The said conference discusses the procedures for advanced materials. The book is divided into four parts. Part 1 includes topics such as preparation of powders from different compounds and substances and the application of different methods and techniques. Part 2 talks about high temperature oxidations and corrosions; degradation resistance of thermal barrier coatings; the environmental effects on corrosion behavior of stainless steel; effect of gas composition and pressure on high temperature corrosion; and other related concepts. Part 3 includes topics such as fatigue-crack behavior; the factors that lead to it; fracture resistance and how it is increased; and the application of ceramics to heat-resistant engines and turbines. Part 4 covers the advanced processing of ceramics, and Part 5 deals with the fabrication of silicon-based ceramics. The text is highly recommended for chemists and engineers in the field of ceramics who would like to know more about the advances in its studies and research.

Bibliography on the High Temperature Chemistry and Physics of Materials

The British National Bibliography

Fracture Fundamentals, High-Temperature Deformation, Damage, and Design

Ceramic Transactions

Self-healing Materials

Structure, Cellular Synthesis and Assembly of Biopolymers

This book details the peculiarities of the requirements for refractories designed for aluminium metallurgical process: reduction, cast house, and anode production. The author describes requirements specific to the properties and structure of refractory materials that differentiate it from the refractories for ferrous metallurgy and other refractories. A comparison is drawn between the properties and structure of refractories and carbon cathode materials from different points of view: from the point of physical chemistry and chemistry interactions during the metallurgical process and from the point of design of reduction pots and furnaces with the aspect to the service life time of metallurgical aggregates.

Based on the author's lectures to graduate students of geosciences, physics, chemistry and materials science, this didactic handbook covers basic aspects of ceramics such as composition and structure as well as such advanced topics as achieving specific functionalities by choosing the right materials. The focus lies on the thermal transformation processes of natural raw materials to arrive at traditional structural ceramics and on the general physical principles of advanced functional ceramics. The book thus provides practice-oriented information to readers in research, development and engineering on how to understand, make and improve ceramics and derived products, while also serving as a rapid reference for the practitioner. The choice of topics and style of presentation make it equally useful for chemists, materials scientists, engineers and mineralogists.

Elements of Structures and Defects of Crystalline Materials has been written to cover not only the fundamental principles behind structures and defects, but also to provide deep insights into understanding the relationships of properties, defect chemistry and processing of the concerned materials. Part One deals with structures, while Part Two covers defects. Since the knowledge of the electron configuration of elements is necessary for understanding the nature of chemical bonding, it is discussed in the opening chapter. Chapter Two then describes the bonding formation within the crystal structures of varied materials, with Chapter Three delving into how a material's structure is formed. In view of the importance of the effects of the structure distortion on the material properties due to the fields, the related topics have been included in section 3.4. Moreover, several materials still under intensive investigation have been illustrated to provide deep insights into understanding the effects of the relationships of processing, structures and defects on the material properties. The defects of materials are explored in Part II. Chapter 4 deals with the point defects of metal and ceramics. Chapter 5 covers the fundamentals of the characteristics of dislocations, wherein physics and the atomic mechanics of several issues have been described in detail. In view of the significant influence of the morphologies including size, shape and distribution of grains, phases on the microstructure evolution, and, in turn, the properties of materials, the final chapter focuses on the fundamentals of interface energies, including single phase (grain) boundary and interphase boundary. Discusses the relationship between properties, defect chemistry and the processing of materials Presents coverage of the fundamental principles behind structures and defects Includes information on two-dimensional and three-dimensional imperfections in solids

Structural CeramicsFundamentals and Case StudiesCambridge University Press

Multiscale Materials Modelling

Materials Characterization Techniques

Comprehensive Hard Materials

Nanocharacterization and Analysis

Nanostructured Ceramics

International Forum on Structural Ceramics Joining

This volume is part of the Ceramic Engineering and Science Proceeding (CESP) series. This series contains a collection of papers dealing with issues in both traditional ceramics (i.e., glass, whitewares, refractories, and porcelain enamel) and advanced ceramics. Topics covered in the area of advanced ceramic include bioceramics, nanomaterials, composites, solid oxide fuel cells, mechanical properties and structural design, advanced ceramic coatings, ceramic armor, porous ceramics, and self-healing ceramics. The book covers self-healing concepts for all important material classes and their applications: polymers, ceramics, non-metallic and metallic coatings, alloys, nanocomposites, concretes and cements, as well as ionomers. Beginning with the inspiration from biological self-healing, its mimicry and conceptual transfer into approaches for the self-repair of artificially created materials, this book explains the strategies and mechanisms for the readers' basic understanding, then covers the application in practical situations. As the first book in this swiftly growing research field, it is of great interest to readers from many scientific and engineering disciplines, such as physics and chemistry, civil, architectural, mechanical, electronics and aerospace engineering.

* Numerous line drawings with consistent format and units allow easy comparison of the behavior of a very wide range of materials * Transmission electron micrographs provide a direct insight in the basic microstructure of metals deforming at high temperatures * Extensive literature review of over 1000 references provide an excellent reference document, and a very balanced discussion Understanding the strength of materials at a range of temperatures is critically important to application in metallurgists, industrial designers, aerospace R&D personnel, and structural engineers. The most up-to-date and comprehensive book in the field, Fundamentals of Creep in Metals and Alloys discusses the fundamentals of time-dependent plasticity or creep in metals, alloys and metallic compounds. This is the first book of its kind that provides broad coverage of a range of materials not just a sub-group such as metallic compounds, superalloys or crystals. As such phenomena are extensively reviewed and analysed in view of an extensive bibliography that includes the most recent publications in the field. All sections of the book have undergone extensive peer review and therefore the reader can be sure they have access to the most up-to-date research, fully interrogated, from the world's leading investigators. - Numerous line drawings with consistent format and units allow easy comparison of the behavior of a very wide range of materials deforming at high temperatures - Extensive literature review of over 1000 references provide an excellent reference document, and a very balanced discussion

This book covers the area of tribology broadly, providing important introductory chapters to fundamentals, processing, and applications of tribology. The book is designed primarily for easy and cohesive understanding for students and practicing scientists pursuing the area of tribology with focus on materials. This book helps students and practicing scientists alike understand that a comprehensive knowledge about the friction and wear properties of advanced materials is essential to design and develop new tribological materials. This book also places importance on the development of new ceramic composites in the context of tribological applications. Some of the key features of the book include: Fundamentals section highlights the salient issues of ceramic processing and mechanical properties of important oxide and non-oxide ceramic systems; State of the art behavior of silicon carbide (SiC) based ceramic composites in dry sliding wear conditions is presented as a case study; Erosion wear behavior of ceramics, in which case studies on high temperature erosion behavior of SiC based composites and zirconium diboride (ZrB2) based composites is also covered; Wear behavior of ceramic coatings is rarely discussed in any tribology related books therefore a case study explaining the abrasion wear behavior of WC-Co coating is provided. Fir

including multiple choice, short answer and long answer are provided.

From Fundamentals to Applications

Refractories for Aluminium

Unit Manufacturing Processes

Mechanical Behaviour of Ceramics

Particulate Products

Ceramic Membranes for Reaction and Separation is the first single-authored guide to the developing area of ceramic membranes. Starting by documenting established procedures of ceramic membrane preparation and characterization, this title then focuses on gas separation. The final chapter covers ceramic membrane reactors;- as distributors and separators, and general engineering considerations. Chapters include key examples to illustrate membrane synthesis, characterisation and applications in industry. Theoretical principles, advantages and disadvantages of using ceramic membranes under the various conditions are discussed where applicable.

Multiscale materials modelling offers an integrated approach to modelling material behaviour across a range of scales from the electronic, atomic and microstructural up to the component level. As a result, it provides valuable new insights into complex structures and their properties, opening the way to develop new, multi-functional materials together with improved process and product designs. Multiscale materials modelling summarises some of the key techniques and their applications.

The various chapters cover the spectrum of scales in modelling methodologies, including electronic structure calculations, mesoscale and continuum modelling. The book covers such themes as dislocation behaviour and plasticity as well as the modelling of structural materials such as metals, polymers and ceramics. With its distinguished editor and international team of contributors, Multiscale materials modelling is a valuable reference for both the modelling community and those in industry. Research and development in materials modelling can help optimise product and process design. Reviews the principles and applications of multi-scale materials modelling Covers themes such as dislocation behaviour and plasticity and the modelling of structural materials Examines the spectrum of scales in modelling methodologies, including electronic structure calculations, mesoscale and continuum modelling

Handbook of Ceramics Grinding and Polishing meets the growing need in manufacturing industries for a clear understanding of the latest techniques in ceramics processing. The properties of ceramics make them very useful as components—they withstand high temperatures and are durable, resistant to wear, chemical degradation, and light. In recent years the use of ceramics has been expanding, with applications in most industry sectors that use machined parts, especially where corrosion-resistance is required, and in high temperature environments. However, they are challenging to produce and their use in high-precision manufacturing often requires adjustments to be made at the micro and nano scale. This book helps ceramics component producers to do cost-effective, highly precise machining. It provides a thorough grounding in the fundamentals of ceramics—their properties and characteristics—and of the abrasive processes used to manipulate their final shape as well as the test procedures vital for success. The second edition has been updated throughout, with the latest developments in technologies, techniques, and materials. The practical nature of the book has also been enhanced; numerous case studies illustrating how manufacturing (machining) problems have been handled are complemented by a highly practical new chapter on the selection and efficient use of machine tools. Provides readers with experience-based insights into complex and expensive processes, leading to improved quality control, lower failure rates, and cost savings Covers the fundamentals of ceramics side-by-side with processing issues and machinery selection, making this book an invaluable guide for downstream sectors evaluating the use of ceramics, as well as those involved in the manufacturing of structural ceramics Numerous case studies from a wide range of applications (automotive, aerospace, electronics, medical devices) Experts must be able to analyze and distinguish all materials, or combinations of materials, in use today—whether they be metals, ceramics, polymers, semiconductors, or composites. To understand a material's structure, how that structure determines its properties, and how that material will subsequently work in technological applications, researchers apply basic principles of chemistry, physics, and biology to address its scientific fundamentals, as well as how it is processed and engineered for use. Emphasizing practical applications and real-world case studies, Materials Characterization Techniques presents the principles of widely used, advanced surface and structural characterization techniques for quality assurance, contamination control, and process improvement. This useful volume: Explores scientific processes to characterize materials using modern technologies Provides analysis of materials' performance under specific use conditions Focuses on the interrelationships and interdependence between processing, structure, properties, and performance Details the sophisticated instruments involved in an interdisciplinary approach to understanding the wide range of mutually interacting processes, mechanisms, and materials Covers electron, X-ray-photoelectron, and UV spectroscopy; scanning-electron, atomic-force, transmission-electron, and laser-confocal-scanning-fluorescent microscopy, and gel electrophoresis chromatography Presents the fundamentals of vacuum, as well as X-ray diffraction principles Explaining appropriate uses and related technical requirements for characterization techniques, the authors omit lengthy and often intimidating derivations and formulations. Instead, they emphasize useful basic principles and applications of modern technologies used to characterize engineering materials, helping readers grasp micro- and nanoscale properties. This text will serve as a valuable guide for scientists and engineers involved in characterization and also as a powerful introduction to the field for advanced undergraduate and graduate students.

Classic and Advanced Ceramics

Principles and Case Studies

Introduction to Materials Science

Fundamentals, Design Strategies, and Applications

Fundamentals and Case Studies

Mullite

Particulate products make up around 80% of chemical products, from all industry sectors. Examples given in this book include the construction materials, fine ceramics and concrete; the delicacies, chocolate and ice cream; pharmaceutical, powders, medical inhalers and sun screen; liquid and powder paints. Size distribution and the shape of the particles provide for different functionalities in these products. Some functions are general, others specific. General functions are powder flow and require – at the typical particulate concentrations of these products – that the particles cause adequate rheological behavior during processing and/or for product performance. Therefore, this book addresses particle packing as well as its relation to powder flow and rheological behavior. Moreover, general relationships to particle size are discussed for e.g. color and sensorial aspects of particulate products, vibration modes in different structures, and different wave types provide all the background needed to understand SHM and apply it to real-world structural challenges. Moving from theory to experimental practice, the book then provides the most comprehensive coverage available on using piezoelectric wafer active sensors (PWAS) to detect and quantify damage in structures. Updates to this edition include circular and straight-crested Lamb waves from first principle, and the interaction between PWAS and Lamb waves in 1-D and 2-D geometries. Effective shear stress is described, and tuning expressions between PWAS and Lamb waves has been extended to cover axisymmetric geometries with a complete Hankel-transform-based derivation. New chapters have been added including hands-on SHM case studies of PWAS stress, strain, vibration, and wave sensing applications, along with new sections covering essential aspects of vibration and wave propagation in axisymmetric geometries. Comprehensive coverage of underlying theory such as piezoelectricity, vibration, and wave propagation alongside experimental techniques Includes step-by-step guidance on the use of piezoelectric wafer active sensors (PWAS) to detect and quantify damage in structures, including clear information on how to interpret sensor signal patterns Updates to this edition include a new chapter on composites and new sections on advances in vibration and wave theory, bringing this established reference in line with the cutting edge in this emerging area

Ceramic Science and Engineering: Basics to Recent Advancements covers the fundamentals, classification and applications surrounding ceramic engineering. In addition, the book contains an extensive review of the current published literature on established ceramic materials. Other sections present an extensive review of up-to-date research on new innovative ceramic materials and reviews recently published articles, case studies and the latest research outputs. The book will be an essential reference resource for materials scientists, physicists, chemists and engineers, postgraduate students, early career researchers, and industrial researchers working in R&D in the development of ceramic materials. Ceramic engineering deals with the science and technology of creating objects from inorganic and non-metallic materials. It combines the principles of chemistry, physics and engineering. Fiber-optic cables, circular panels are just a few examples of ceramic engineering being applied in everyday life. Advanced ceramics such as alumina, aluminum nitride, zirconia, ZnO, silicon carbide, silicon nitride and titania-based materials, each of which have their own specific characteristics and offer an economic and high-performance alternative to more conventional materials such as glass, metals and plastics are also discussed. Covers environmental barrier ceramic coatings, advanced ceramic conductive fuel cells, processing and machining technology in ceramic and composite materials, photoluminescent ceramic materials, perovskite ceramics and bioinspired ceramic materials Reviews both conventional, established ceramics and new, innovative advanced ceramics Contains an extensive review of the current published literature on established ceramic materials

Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database.

Advanced Materials '93

Refractories for Aluminum

Structural Health Monitoring with Piezoelectric Wafer Active Sensors

Fracture of Brittle Disordered Materials: Concrete, Rock and Ceramics

Fracture Mechanics of Ceramics

Processes, Properties, and Applications

This book helps students and practicing scientists alike understand that a comprehensive knowledge about the friction and wear properties of advanced materials is essential to further design and development of new materials. With important introductory chapters on the fundamentals, processing, and applications of tribology, the book then examines in detail the nature and properties of materials, the friction and wear of structural ceramics, bioceramics, biocomposites, and nanoceramics, as well as lightweight composites and the friction and wear of ceramics in a cryogenic environment.

Manufacturing, reduced to its simplest form, involves the sequencing of product forms through a number of different processes. Each individual step, known as an unit manufacturing process, can be viewed as the fundamental building block of a nation's manufacturing capability. A committee of the National Research Council has prepared a report to help define national priorities for research in unit processes. It contains an organizing framework for unit process families, criteria for determining the criticality of a process or manufacturing technology, examples of research opportunities, and a prioritized list of enabling technologies that can lead to the manufacture of products of superior quality at competitive costs. The study was performed under the sponsorship of the National Science Foundation and the Defense Department's Manufacturing Technology Program.

These volumes, 9 and 10, of Fracture Mechanics of Ceramics constitute the proceedings of an international symposium on the fracture mechanics of ceramic materials held at the Japan Fine Ceramics Center, Nagoya, Japan on July 15, 16, 17, 1991. These proceedings constitute the fifth pair of volumes of a continuing series of conferences. Volumes 1 and 2 were from the 1973 symposium, volumes 3 and 4 from a 1977 symposium, and volumes 5 and 6 from a 1981 symposium all of which were held at The Pennsylvania State University. Volumes 7 and 8 are from the 1985 symposium which was held at the Virginia Polytechnic Institute and State University. The theme ofthis conference, as for the previous four, focused on the mechanical behavior ofceramic materials in terms of the characteristics ofcracks, particularly the roles which they assume in the fracture processes and mechanisms. The 82 contributed papers by over 150 authors and co-authors represent the current state of that field. They address many of the theoretical and practical problems ofinterest to those scientists and engineers concerned with brittle fracture.

This 1979 book presents the scientific foundations of mechanical behaviour and demonstrates how these can be used in engineering situations in relation to ceramics.

Ceramic Materials

Ceramics, Powders, Corrosion and Advanced Processing

Fundamentals of Ceramics

Tailoring Properties for Optimal Performance

A Materials Science Perspective

Scientific and Technical Aerospace Reports

-. Materials Science & Technology 2010 Conference & Exhibition (MS&T'10), Houston TX, October 17-22, 2010"--Pref.

This book details the rigorous requirements for refractories designed for aluminium metallurgical processes: reduction, cast house, and anode production. The author describes requirements specific to the properties and structure of refractory materials that differentiate it from materials used for ferrous metallurgy, among others. A comparison is drawn between the properties and structure of refractories and carbon cathode materials from different points of view: from the perspective of physical chemistry and chemical interactions during the metallurgical process and from the aspect of designing reduction pots and furnaces to accommodate the lifetime of metallurgical aggregates that are a part of aluminum refractory processes.

This book derives from the invited IUTAM Symposium in September 1993. The contributions discuss recent advances in fracture mechanics studies of concrete, rock, ceramics and other brittle disordered materials at micro and structural levels. It draws together research and new applications in continuum, damage and fracture mechanics approaches.

The booky book to provide a complete survey from the crystallographic fundamentals right up to recent high-tech applications in aerospace technology. Following a general introduction to the topic, the authors go on to cover the crystal chemistry of mullite and related phases, as well as its basic properties, phase equilibria and stability. One whole section is devoted to the synthesis and processing of mullite ceramics, while later ones cover mullite coatings, fibers and matrix composites. For materials scientists, solid state chemists and physicists, crystallographers and mineralogists.

Fundamentals of Creep in Metals and Alloys

Processing and Properties of Advanced Ceramics and Composites III

Physical Fundamentals, Modelling and Rational Applications

Handbook of Ceramics Grinding and Polishing

Ceramic Science and Engineering

Light Metals 2014

Many naturally occurring biopolymers have unique structures and unique physical or mechanical properties. The understand- ing of the molecular basisof these biomolecules, their syn- thesis, assembly and processing is a prerequisite for any ap- plication to the design of novel biomolecular materials. Se- veral classes of biopolymers are sampled in depth in this volume, such as nanolaminated ceramics, adhesive proteins, eggshellproteins, protein fibres and silk which are synthe- sized by a variety of organisms (molluscs, parasitic trem- atodes, fish and insects). The reader will be introduced to the biological systems to understand Nature's use of each biopolymer and the highly differentiated cells responsible for their synthesis. Corresponding to the variety of organ- isms and possible applications of biopolymers, the combined expertise of interdisciplinary teams of scientists - such as the authors of this volume - have thegreatopportunity to decipher and exploit Nature's skill in biopolymer engi- neering.

Comprehensive Hard Materials deals with the production, uses and properties of the carbides, nitrides and borides of these metals and those of titanium, as well as tools of ceramics, the superhard boron nitrides and diamond and related compounds. Articles include the technologies of powder production (including their precursor materials), milling, granulation, cold and hot compaction, sintering, hot isostatic pressing, hot-pressing, injection moulding, as well as on the coating technologies for refractory metals, hard metals and hard materials. The characterization, testing, quality assurance and applications are also covered. Comprehensive Hard Materials provides meaningful insights on materials at the leading edge of technology. It aids continued research and development of these materials and as such it is a critical information resource to academics and industry professionals facing the technological challenges of the future. Hard materials operate at the leading edge of technology, and continued research and development of such materials is critical to meet the technological challenges of the future. Users of this work can improve their knowledge of basic principles and gain a better understanding of process/structure/property relationships. With the convergence of nanotechnology, coating techniques, and functionally graded materials to the cognitive science of cemented carbides, cermets, advanced ceramics, super-hard materials and composites, it is evident that the full potential of this class of materials is far from exhausted. This work unites these important areas of research and will provide useful insights to users through its extensive cross-referencing and thematic presentation. To link academic to industrial usage of hard materials and vice versa, this work deals with the production, uses and properties of the carbides, nitrides and borides of these metals and those of titanium, as well as tools of ceramics, the superhard boron nitrides and diamond and related compounds.

The Light Metals symposia are a key part of the TMS Annual Meeting & Exhibition, presenting the most recent developments, discoveries, and practices in primary aluminum science and technology. Publishing the proceedings from these important symposia, the Light Metals volume has become the definitive reference in the field of aluminum production and related light metal technologies. The 2014 collection includes papers from the following symposia: •Alumina and Bauxite •Aluminum Alloys: Fabrication, Characterization and Applications •Aluminum Processing •Aluminum Reduction Technology •Cast Shop for Aluminum Production •Electrode Technology for Aluminum Production •Light-metal Matrix (Nano)-composites

Ceramic Membranes for Separation and Reaction

Fundamentals and Applications

Basics to Recent Advancements

Elements of Structures and Defects of Crystalline Materials

Hybrid Manufacturing Processes

Proceedings of the Unified International Technical Conference on Refractories (UNITECR 2013)