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Corrosion Protection and Control Using Nanomaterials - V S Saji 2012-02-21

Corrosion is an expensive and potentially dangerous problem in many industries. The potential application of different nanostructured materials in corrosion protection, prevention and control is a subject of increasing interest.

Corrosion protection and control using nanomaterials explores the potential use of nanotechnology in corrosion control. The book is divided into two parts. Part one looks at the fundamentals of corrosion behaviour and the manufacture of nanocrystalline materials.

Chapters discuss the impact of nanotechnology in reducing corrosion cost, and investigate the influence of various factors including thermodynamics, kinetics and grain size on the corrosion behaviour of nanocrystalline materials.

There are also chapters on electrodeposition and the corrosion behaviour of electrodeposited nanocrystalline materials. Part two provides a series of case studies of applications of nanomaterials in corrosion control. Chapters review oxidation protection using nanocrystalline structures at various temperatures, sol- gel and self-healing nanocoatings and the use of nanoreservoirs and polymer nanocomposites in corrosion control.

With its distinguished editors and international team of expert contributors, Corrosion

protection and control using nanomaterials is an invaluable reference tool for researchers and engineers working with nanomaterials in a variety of industries including, aerospace, automotive and chemical engineering as well as academics studying the unique protection and control offered by nanomaterials against corrosion. Explores the potential use of nanotechnology and nanomaterials for corrosion prevention, protection and control Discusses the impact of nanotechnology in reducing corrosion cost and investigates various factors on the corrosion behaviour of nanocrystalline materials Provides a series of case studies and applications of nanomaterials for corrosion control

Chemical Solution Synthesis for Materials Design and Thin Film Device Applications - Soumen Das 2021-01-09

Chemical Solution Synthesis for Materials Design and Thin Film Device Applications presents current research on wet chemical techniques for thin-film based devices. Sections cover the quality of thin films, types of common films used in devices, various thermodynamic properties, thin film patterning, device configuration and applications. As a whole, these topics create a roadmap for developing new materials and incorporating the results in device fabrication. This book is suitable for graduate,

undergraduate, doctoral students, and researchers looking for quick guidance on material synthesis and device fabrication through wet chemical routes. Provides the different wet chemical routes for materials synthesis, along with the most relevant thin film structured materials for device applications Discusses patterning and solution processing of inorganic thin films, along with solvent-based processing techniques Includes an overview of key processes and methods in thin film synthesis, processing and device fabrication, such as nucleation, lithography and solution processing

Nanocoatings and Ultra-Thin Films - Abdel Salam Hamdy Makhlouf 2011-09-14

Coatings are used for a wide range of applications, from anti-fogging coatings for glass through to corrosion control in the aerospace and automotive industries. Nanocoatings and ultra-thin films provides an up-to-date review of the fundamentals, processes of deposition, characterisation and applications of nanocoatings. Part one covers technologies used in the creation and analysis of thin films, including chapters on current and advanced coating technologies in industry, nanostructured thin films from amphiphilic molecules, chemical and physical vapour deposition methods and methods for analysing nanocoatings and ultra-thin films. Part two focuses on the applications of nanocoatings and ultra-thin films, with chapters covering topics such as nanocoatings for architectural glass, packaging applications, conventional and smart nanocoatings for corrosion protection in aerospace engineering and ultra-thin membranes for sensor applications. With its distinguished editors and international team of contributors, *Nanocoatings and ultra-thin films* is an essential reference for professional engineers in the glazing, construction, electronics and transport industries, as well as all those with an academic research interest in the field. Provides an up-to-date review of the fundamentals, processes of deposition, characterisation and applications of nanocoatings Focuses on the applications of nanocoatings and ultra-thin films, covering topics such as nanocoatings for architectural glass, packaging applications and ultra-thin membranes for sensor applications Includes

chapters on current and advanced coating technologies in industry, nanostructured thin films from amphiphilic molecules, chemical and physical vapour deposition methods and methods for analysing nanocoatings and ultra-thin films

Nanotechnology Safety - Ramazan Asmatulu 2013-06-12

Nanotechnology is a new and emerging discipline that is multidisciplinary and interdisciplinary. The usage of nanosystems, nanomaterials, nano-devices, etc. permeates all aspects of society. Cancer targeting and curing nanosystems are being introduced into the biomedical and pharmaceutical industries; so are lightweight energy absorbing or blast-proof nanohybrid material in the aerospace, automotive and marine industries and high-efficiency energy harvesting nanomaterials, etc. Society has a vested interest in knowing how these new materials, devices and systems are changing the economy and similar landscapes. The book outlines the regulatory and environmental issues related to nanotechnology per industry, offers guidelines in assessing the risks and discusses the legal and socioeconomical issues involved. Case studies will be utilized to provide examples of the positive and negative impacts of nanotechnology. Provides an overview and the basis for understanding the critical importance of the reactivity and efficacy of nanomaterials and the emerging role of nanotechnology in society Explains the fundamentals, ethics, regulatory and environmental issues of nanosafety and how they shape the emerging nanotechnology industry and markets and includes extensive lists of glossary terms, terminologies and concepts needed for Material Data Safety Sheets Discusses the relevance and specificity of nanosafety issues per industry and includes discussions on the "Homeland Security and Infrastructure Industries" of interest to society in general Includes nanotechnology risk assessment and delineates and quantifies the risk assessment process for nanotechnology safety of paramount importance to most industries and systems Outlines the legal and intellectual property ramifications of nanotechnology and its impact on productivity and society

Industrial Applications for Intelligent Polymers and Coatings - Majid Hosseini

2016-05-14

This book is a comprehensive collaboration on intelligent polymers and coatings for industrial applications by worldwide researchers and specialists. The authors cover the basis and fundamental aspects of intelligent polymers and coatings, challenges, and potential mechanisms and properties. They include recent and emerging industrial applications in medical, smart textile design, oil and gas, electronic, aerospace, and automobile industries as well as other applications including microsystems, sensors, and actuators, among others. The authors discuss the potential for future research in these areas for improvement and growth of marketable applications of intelligent polymers and coatings.

Metal Oxide Nanoparticles - Oliver Diwald

2021-08-25

Ein umfassendes Referenzwerk für Chemiker und Industriefachleute zum Thema Nanopartikel Nanopartikel aus Metalloxid sind ein wesentlicher Bestandteil zahlreicher natürlicher und technologischer Prozesse ? von der Mineralumwandlung bis zur Elektronik. Darüber hinaus kommen Metalloxid-Nanopartikel in Pulverform im Maschinenbau, in der Elektronik und der Energietechnik zum Einsatz. Das Werk *Metal Oxide Nanoparticles: Formation, Functional Properties and Interfaces* stellt die wichtigsten Synthese- und Formierungsansätze bei der Nutzung von Metalloxid-Nanopartikeln als Funktionsmaterialien vor. Es werden die üblichen Verarbeitungswege erklärt und die physikalischen und chemischen Eigenschaften der Partikel mithilfe von umfassenden und ergänzenden Charakterisierungsmethoden bewertet. Dieses Werk kann als Einführung in die Formulierung von Nanopartikeln, ihre Grenzflächenchemie und ihre funktionellen Eigenschaften im Nanobereich genutzt werden. Darüber hinaus dient es zum vertiefenden Verständnis, denn das Buch enthält detaillierte Angaben zu fortschrittlichen Methoden bei der physikalischen, chemischen, Oberflächen- und Grenzflächencharakterisierung von Metalloxid-Nanopartikeln in Pulvern und Dispersionen. *Erläuterung der Anwendung von Metalloxid-

Nanopartikeln und der wirtschaftlichen Auswirkungen *Betrachtung der Partikelsynthese, einschließlich der Grundsätze ausgewählter Bottom-up-Strategien *Untersuchung der Formulierung von Nanopartikeln mit einer Auswahl von Verarbeitungs- und Anwendungswegen *Diskussion der Bedeutung von Partikeloberflächen und -grenzflächen für Strukturbildung, Stabilität und funktionelle Materialeigenschaften *Betrachtung der Charakterisierung von Metalloxid-Nanopartikeln auf verschiedenen Längenskalen In diesem Buch finden Forscher im akademischen Bereich, Chemiker in der Industrie und Doktoranden wichtige Erkenntnisse über die Synthese, Eigenschaften und Anwendungen von Metalloxid-Nanopartikeln.

Defect Structure in Nanomaterials - J Gubicza

2012-06-01

Nanomaterials exhibit unique mechanical and physical properties compared to their coarse-grained counterparts, and are consequently a major focus of current scientific research. Defect structure in nanomaterials provides a detailed overview of the processing methods, defect structure and defect-related mechanical and physical properties of a wide range of nanomaterials. The book begins with a review of the production methods of nanomaterials, including severe plastic deformation, powder metallurgy and electrodeposition. The lattice defect structures formed during the synthesis of nanomaterials are characterised in detail. Special attention is paid to the lattice defects in low stacking fault energy nanomaterials and metal - carbon nanotube composites. Topics covered in the second part of the book include a discussion of the thermal stability of defect structure in nanomaterials and a study of the influence of lattice defects on mechanical and hydrogen storage properties. Gives in-depth, physically based explanations for the relationships between the defect structure and mechanical properties of nanomaterials Covers a wide range of nanomaterials including metals; alloys; ceramics; diamond; carbon nanotubes and their composites Provides a detailed characterization of the lattice defect structure in nanomaterials

Graphene Science Handbook, Six-Volume

Set - Mahmood Aliofkhaezai 2016-04-26

Graphene is the strongest material ever studied and can be an efficient substitute for silicon.

This six-volume handbook focuses on fabrication methods, nanostructure and atomic

arrangement, electrical and optical properties,

mechanical and chemical properties, size-

dependent properties, and applications and

industrialization. There is no other major

reference work of this scope on the topic of

graphene, which is one of the most researched

materials of the twenty-first century. The set

includes contributions from top researchers in

the field and a foreword written by two Nobel

laureates in physics. Volumes in the set: K20503

Graphene Science Handbook: Mechanical and Chemical Properties (ISBN: 9781466591233)

K20505 Graphene Science Handbook:

Fabrication Methods (ISBN: 9781466591271)

K20507 Graphene Science Handbook: Electrical and Optical Properties (ISBN: 9781466591318)

K20508 Graphene Science Handbook:

Applications and Industrialization (ISBN:

9781466591332) K20509 Graphene Science

Handbook: Size-Dependent Properties (ISBN:

9781466591356) K20510 Graphene Science

Handbook: Nanostructure and Atomic

Arrangement (ISBN: 9781466591370)

Future Development of Thermal Spray Coatings -

Nuria Espallargas 2015-06-29

Future Development of Thermal Spray Coatings discusses the latest developments and research trends in the thermal spray industry. The book

presents a timely guide to new applications and

techniques. After an introduction to thermal

spray coatings by the editor, Part One covers

new types and properties of thermal spray

coatings. Chapters look at feedstock suspensions

and solutions, the application of solution

precursor spray techniques to obtain ceramic

films and coatings, cold spray techniques and

warm spray technology amongst others. Part

Two of the book moves on to discuss new

applications for thermal spray coatings such as

the use of thermal spray coatings in

environmental barrier coatings, thermal spray

coatings in renewable energy applications and

manufacturing engineering in thermal spray

technologies by advanced robot systems and

process kinematics. Timely guide on the current

advancements and research trends in thermal

spray technology Reviews different types of thermal spray coatings Presents a wide variety of applications for this emerging technology

Intelligent Coatings for Corrosion Control -

Atul Tiwari 2014-10-25

Intelligent Coatings for Corrosion Control covers

the most current and comprehensive information

on the emerging field of intelligent coatings. The

book begins with a fundamental discussion of

corrosion and corrosion protection through

coatings, setting the stage for deeper discussion

of the various types of smart coatings currently

in use and in development, outlining their

methods of synthesis and characterization, and

their applications in a variety of corrosion

settings. Further chapters provide insight into

the ongoing research, current trends, and

technical challenges in this rapidly progressing

field. Reviews fundamentals of corrosion and

coatings for corrosion control before delving into

a discussion of intelligent coatings—useful for

researchers and grad students new to the

subject Covers the most current developments in

intelligent coatings for corrosion control as

presented by top researchers in the field

Includes many examples of current and potential

applications of smart coatings to a variety of

corrosion problems

Underground Pipeline Corrosion - Mark

Orazem 2014-02-17

Underground pipelines transporting liquid

petroleum products and natural gas are critical

components of civil infrastructure, making

corrosion prevention an essential part of asset-

protection strategy. Underground Pipeline

Corrosion provides a basic understanding of the

problems associated with corrosion detection

and mitigation, and of the state of the art in

corrosion prevention. The topics covered in part

one include: basic principles for corrosion in

underground pipelines, AC-induced corrosion of

underground pipelines, significance of corrosion

in onshore oil and gas pipelines, numerical

simulations for cathodic protection of pipelines,

and use of corrosion inhibitors in managing

corrosion in underground pipelines. The

methods described in part two for detecting

corrosion in underground pipelines include:

magnetic flux leakage, close interval potential

surveys (CIS/CIPS), Pearson surveys, in-line

inspection, and use of both electrochemical and

optical probes. While the emphasis is on pipelines transporting fossil fuels, the concepts apply as well to metallic pipes for delivery of water and other liquids. *Underground Pipeline Corrosion* is a comprehensive resource for corrosion, materials, chemical, petroleum, and civil engineers constructing or managing both onshore and offshore pipeline assets; professionals in steel and coating companies; and academic researchers and professors with an interest in corrosion and pipeline engineering. Reviews the causes and considers the detection and prevention of corrosion to underground pipes. Addresses a lack of current, readily available information on the subject. Case studies demonstrate how corrosion is managed in the underground pipeline industry.

Construction 4.0 - Marco Casini 2021-12-01

At the beginning of the Fourth Industrial Revolution, the advent of digitalization, innovative technologies and materials, and new construction techniques have begun transforming the way that infrastructure, real estate, and other built assets can be designed, constructed, and operated in order to create a more attractive, energy-efficient, comfortable, affordable, safe, and sustainable built environment. Developments in materials and cutting-edge technologies (such as artificial intelligence, robotics, nanotechnology, 3D printing, and biotechnology) have finally started to move the construction towards a new era. Massive changes are occurring as a result of the possibilities created by big data and the Internet of Things, along with the technological advances that are driving down the cost of sensors, data storage, and computer services. *Construction 4.0: Advanced Technology, Tools and Materials for the Digital Transformation of the Construction Industry* presents a thorough review of developments in materials, emerging trends, cutting-edge technologies, and strategies in the fields of smart building design, construction, and operation, providing the reader with a comprehensive guideline on how to exploit the new possibilities offered by the digital revolution. It will be an essential reference resource for academic researchers, material scientists, and civil engineers, undergraduate and graduate students, and other professionals working in the fields of smart eco-

efficient construction and cutting-edge technologies applied to construction. Features discussions on how nanomaterials, bio-based materials, and recycled materials are applied in the construction of buildings. Analyzes the lifecycle of materials, buildings and design and construction operations. Covers new methodologies and construction processes. Provides case studies on cutting-edge digital technology such as AI and machine learning. Examines all aspects of sustainability, including end-of-life of buildings.

Materials Science and Engineering: Concepts, Methodologies, Tools, and Applications - Management Association, Information Resources 2017-01-11

The design and study of materials is a pivotal component to new discoveries in the various fields of science and technology. By better understanding the components and structures of materials, researchers can increase its applications across different industries. *Materials Science and Engineering: Concepts, Methodologies, Tools, and Applications* is a compendium of the latest academic material on investigations, technologies, and techniques pertaining to analyzing the synthesis and design of new materials. Through its broad and extensive coverage on a variety of crucial topics, such as nanomaterials, biomaterials, and relevant computational methods, this multi-volume work is an essential reference source for engineers, academics, researchers, students, professionals, and practitioners seeking innovative perspectives in the field of materials science and engineering.

Magnetic Nanoparticles - Evgeny Katz 2020-03-05

The present book covers all research areas related to magnetic nanoparticles, magnetic nanorods, and other magnetic nanospecies, their preparation, characterization, and various applications, specifically emphasizing biomedical applications. The chapters written by the leading experts cover different subareas of the science and technology related to various magnetic nanospecies—providing broad coverage of this multifaceted area and its applications. The different topics addressed in this book will be of great interest to the interdisciplinary community active in the area of nanoscience and

nanotechnology. It is hoped that this collection and its various chapters will be important and beneficial for researchers and students working in various areas related to bionanotechnology, materials science, biosensor applications, medicine, and many others. Furthermore, this book is aimed at attracting young scientists and introducing them to this field, in addition to providing newcomers with an enormous collection of literature references.

Graphene Science Handbook - Mahmood Aliofkhaezrai 2016-04-21

Size Up the Short- and Long-Term Effects of GrapheneThe Graphene Science Handbook is a six-volume set that describes graphene's special structural, electrical, and chemical properties. The book considers how these properties can be used in different applications (including the development of batteries, fuel cells, photovoltaic cells, and supercapac

Nanotechnology in Eco-efficient

Construction - Fernando Pacheco-Torgal 2018-11-22

Covering the latest technologies, Nanotechnology in eco-efficient construction provides an authoritative guide to the role of nanotechnology in the development of eco-efficient construction materials and sustainable construction. The book contains a special focus on applications concerning concrete and cement, as nanotechnology is driving significant development in concrete technologies. The new edition has 14 new chapters, including 3 new parts: Mortars and concrete related applications; Applications for pavements and other structural materials; and Toxicity, safety handling and environmental impacts. Civil engineers requiring an understanding of eco-efficient construction materials, as well as researchers and architects within any field of nanotechnology, eco-efficient materials or the construction industry will find this updated reference to be highly valuable. Addresses issues such as toxicity and LCA aspects New chapters covering safety handling on occupational exposure of nanoparticles and the assessment of personal exposure to airborne nanomaterials Discusses the effects of adding nano-particles on the durability and on the properties of geopolymers

Advances in Powder Metallurgy - Isaac Chang

2013-08-31

Powder metallurgy (PM) is a popular metal forming technology used to produce dense and precision components. Different powder and component forming routes can be used to create an end product with specific properties for a particular application or industry. Advances in powder metallurgy explores a range of materials and techniques used for powder metallurgy and the use of this technology across a variety of application areas. Part one discusses the forming and shaping of metal powders and includes chapters on atomisation techniques, electrolysis and plasma synthesis of metallic nanopowders. Part two goes on to highlight specific materials and their properties including advanced powdered steel alloys, porous metals and titanium alloys. Part three reviews the manufacture and densification of PM components and explores joining techniques, process optimisation in powder component manufacturing and non-destructive evaluation of PM parts. Finally, part four focusses on the applications of PM in the automotive industry and the use of PM in the production of cutting tools and biomaterials. Advances in powder metallurgy is a standard reference for structural engineers and component manufacturers in the metal forming industry, professionals working in industries that use PM components and academics with a research interest in the field. Discusses the forming and shaping of metal powders and includes chapters on atomisation techniques Highlights specific materials and their properties including advanced powdered steel alloys, porous metals and titanium alloys Reviews the manufacture and densification of PM components and explores joining techniques

Handbook of Research on Recent Developments in Materials Science and Corrosion Engineering Education - Lim, Hwee Ling 2015-02-28
The latest research innovations and enhanced technologies have altered the discipline of materials science and engineering. As a direct result of these developments, new trends in Materials Science and Engineering (MSE) pedagogy have emerged that require attention. The Handbook of Research on Recent Developments in Materials Science and Corrosion Engineering Education brings together innovative and current advances in the

curriculum design and course content of MSE education programs. Focusing on the application of instructional strategies, pedagogical frameworks, and career preparation techniques, this book is an essential reference source for academicians, engineering practitioners, researchers, and industry professionals interested in emerging and future trends in MSE training and education.

Solid Oxide-Based Electrochemical Devices - Massimiliano Lo Faro 2020-03-26

Solid Oxide-Based Electrochemical Devices: Advances, Smart Materials and Future Energy Applications provides a complete overview of the theoretical and applied aspects of energy-related solid oxide technologies. The book presents detailed thermodynamic and other basic requirements for fuel cells, electrolyzers, supercapacitors, batteries, sensors and air treatment devices. It delves into physical-chemical, electrochemical and mechanical properties of smart materials developed and offers insights into fundamental analysis and modeling. Detailed protocols for operation are suggested and discussed, including component development to optimize functionality, cost and upscaling. Practitioners in the fuel cell or power to gas industries, engineering researchers developing new technologies in those areas, and device and system designers can use the in-depth, structured information about the relationship between technologies and materials offered to make better-informed decisions during the planning and implementation of those technologies. Covers the theoretical concepts, components, advances and applications of solid oxide fuel cell, electrolyzer, battery, sensor and pollution abatement technologies Explores applications of new smart and metamaterials in the construction of energy-related solid oxide devices Presents examples of prototypes, including their cost estimate and requirements for large-scale production, integration and operation

Advances In Smart Coatings And Thin Films For Future Industrial and Biomedical Engineering Applications - Abdel Salam Hamdy Makhlouf 2019-10-25

Advances In Smart Coatings And Thin Films For Future Industrial and Biomedical Engineering Applications discusses in detail, the recent

trends in designing, fabricating and manufacturing of smart coatings and thin films for future high-tech. industrial applications related to transportation, aerospace and biomedical engineering. Chapters cover fundamental aspects and diverse approaches used to fabricate smart self-healing anti-corrosion coatings, shape-memory coatings, polymeric and nano-bio-ceramic coatings, bio-inspired and stimuli-responsive coatings for smart surfaces with antibacterial activity and controlled wettability, and electrically conductive coatings and their emerging applications. With the emphasis on advanced methodologies and recent emerging applications of smart multifunctional coatings and thin films, this book is essential reading for materials scientists and researchers working in chemical sciences, advanced materials, sensors, pharmaceutical and biomedical engineering. Discusses the most recent advances and innovations in smart multifunctional coatings and thin films in the transportation, aerospace and biomedical engineering industries Highlights the synthesis methods, processing, testing and characterization of smart coatings and thin films Reviews the current prospects and future trends within the industry

Anticorrosive Nanomaterials - Chandrabhan Verma 2022-05-09

Corrosion causes permanent damage to metal surfaces and is a major global challenge, spanning numerous fields including industrial sectors, construction materials, and surface treatments for metallic cultural heritage preservation. Nanomaterials and nanocomposites can be used as effective alternative corrosion inhibitors in the place of traditional environmentally toxic substances. This book provides readers with an overview of the properties and applications of nanomaterials and nanocomposites as corrosion inhibitors. Chapters first cover the basics of nanomaterials and the features that make them useful candidates, before highlighting recent advances from across the field for industry-oriented challenges. With a focus on cutting-edge research, this book is a valuable resource for chemists, chemical engineers, material scientists and environmental chemists in both academia and industry who want to learn more about

corrosion inhibitors and mechanisms.
Nanotechnology Applications for Food Safety and Quality Monitoring - Arun Sharma
2022-11-15

Nanotechnology Applications for Food Safety and Quality Monitoring brings together nanotechnology science-based research for food safety and quality monitoring. With the advancement in knowledge about behavior of nano-engineered materials in food and its toxicity, the application of nanotechnology is expected to reach unprecedented levels in achieving food safety. Currently, there is no practical resource of nanotechnology as a tool specifically for monitoring safety and quality. This is a practical, concise, applications-based reference that is essential for food industry researchers and scientists to monitor the safety and quality of food to ensure quality food supplies. Demonstrates how nanotechnology can improve food safety and quality Shows how nanotechnology sensors can be used for food pesticides, pathogens and microbes Discusses the benefits and risks of nanotechnology applications for food safety

Nanofiber Membranes for Medical, Environmental, and Energy Applications - Ahmad Fauzi Ismail 2019-07-30

This book focuses on the nanofiber membrane's fabrication, characterization, and performance for medical, environment and energy applications. Topics include polymer, inorganic and composite-form nanofiber membrane materials. Top Research teams from varied disciplines and continents outline applied nanofiber membrane fabrication techniques and characterizations. Promising nanofiber membranes for improving and enhancing technologies used in drug delivery, wound healing, tissue engineering, water and wastewater treatment and purification, gas separation and purification, air purification, and fuel cells are discussed along with the likely path forward for commercial usage. Key Features: Shares the most recent discovery solutions from experts all over the globe for the numerous problems in medical, environmental and energy applications. Provides a holistic cycle of nanofiber membrane development which comprehensively discusses the membrane preparation, characterizations, performance and

the way forward for a specific process and application. Explains the mechanism of separation and purification. Focuses on the nanofiber membrane's fabrication, characterizations, and performance in various scenarios and commercial applications.

Nanotechnology in the Automotive Industry - Huaihe Song 2022-04-10

Nanotechnology in the Automotive Industry explores how nanotechnology and nanomaterials are used to enhance the performance of materials and devices for automotive application by fabricating nano-alloys, nanocomposites, nano coatings, nanodevices, nanocatalysts and nanosensors. Consisting of 36 chapters in 6 parts, this new volume in the Micro and Nano Technologies series is for materials scientists, nanotechnologists and automotive engineers working with nanotechnology and nanomaterials for automotive applications. Nanotechnology is seen as one of the core technologies for the future automotive industry to sustain competitiveness. The benefits that nanotechnology brings to the automotive sector include stronger and lighter materials for increased safety and reduced fuel consumption, improved engine performance and fuel consumption for gasoline powered vehicles due to nanocatalysts, fuel additives and lubricants, and more. Discusses various approaches and techniques such as nanoalloys, nanocomposites, nanocoatings, nanodevices, nanocatalysts and nanosensors used in modern vehicles Presents the challenges and future of automotive materials Explores how nanotechnology and nanomaterials are used to enhance the performance of materials and devices for automotive applications

Self-Healing Composite Materials - Anish Khan 2019-10-30

Self-Healing Composite Materials: From Designs to Applications provides a unique resource on self-healing composites for materials scientists and engineers in academia, as well as researchers involved in the aerospace, automotive, wind-generation, construction, consumer goods and marine industries. There is a huge demand for self-healing composites that respond to their environment like living matter. Unlike other composites, self-healing composites are combined with carbon materials and resins

to form a recoverable composite material. This book covers the manufacturing, design and characterization of self-healing composites, including their morphological, structural, mechanical, thermal and electrical properties. The title begins with mathematical background and then considers innovative approaches to physical modeling, analysis and design techniques, providing a robust knowledge of modern self-healing composites with commercial applications. Covers composite fabrication from polymer, nano oxides, epoxy and plastics Gives detailed examples on how self-healing composites may be used Provides readers with a robust knowledge of self-healing composites Presents a unified approach to these human-friendly, commercially valuable materials

Iron Ore - Liming Lu 2015-07-24

Iron Ore: Mineralogy, Processing and Environmental Issues summarizes recent, key research on the characterization of iron ores, including important topics such as beneficiation (separation and refining), agglomeration (e.g., production of pellets or powders), blast furnace technology for smelting, and environmental issues relating to its production. The text is an ideal reference on the topic during a time when iron ore production has increased significantly, driven by increasing demand from countries such as India and China. Provides a comprehensive overview of the global iron ore industry, exploring its characteristics and characterization Expert analysis of quality requirements for iron production, iron ore agglomeration technologies, environmental issues, and low-emission technologies Timely text to accompany the increased iron ore production occurring in developing countries like India and China

Self-Healing Materials - George Wypych 2022-04-01

Self-Healing Materials: Principles and Technology, Second Edition provides engineers and researchers in both industry and academia the information they need to deploy self-healing technology in a range of potential applications, from adhesives to the automotive industry, and from electronics to biomedical implants. Sections discuss the principal mechanisms of self-healing and how these are applied to the development of materials that have the ability to

repair themselves, either with minimal or no human intervention. In addition, the book provides a theoretical background and a review of the major research undertaken to date, providing a thorough grounding in this concept and related technology. Other sections compare the parameters of different self-healing technological processes, such as fault detection mechanisms, methods of triggering and turning off the healing processes, the activation energy of self-healing processes, the means and methods of delivery of the healing substances to the defect locations, self-healing timescale (rate of self-healing), and the extent of self-healing (healing efficiency, recovery of properties, etc.). In addition, mathematical modeling of the processes of self-healing (molecular dynamics simulation), the morphology of healed areas, and other important topics are thoroughly discussed. Helps materials scientists and engineers reduce risk of degradation and materials failure by using self-healing materials in a range of applications Provides real-world application examples so practitioners can assess the applicability and usefulness of self-healing materials in their work Includes guidance on the efficiency and efficacy of self-healing mechanisms, with coverage of different parameters considered and methodologies used Discusses typical aids and additives in self-healing materials, including plasticizers, catalysts, shape-memory components, and more

Rare Earth-Based Corrosion Inhibitors -

Maria Forsyth 2014-08-12

Corrosion inhibitors are an important method for minimizing corrosion; however traditional inhibitors such as chromates pose environmental problems. Rare earth metals provide an important, environmentally-friendly alternative. This book provides a comprehensive review of current research and examines how rare earth metals can be used to prevent corrosion and applied to protect metals in such industries as aerospace and construction. Chapter 1 begins by examining the important need to replace chromate, and then goes on to discuss the chemistry of the rare earth metals and their related compounds. Chapter 2 considers the techniques that can be used to identify corrosion inhibition mechanisms and to test the levels of protection offered to different metals by rare

earth compounds. Subsequent chapters consider in more detail how rare earth elements can be used as corrosion inhibitors in different forms and for different metals. This includes discussion on the potential of rare earth elements for self-healing, tunable and multifunctional coatings. Finally, chapter 10 considers the cost and availability of the rare earths and the potential health and environmental risks associated with extracting them. Provides a review of current research and examines how rare earth metals can be used to prevent corrosion and applied to protect metals in such industries as aerospace and construction. Includes discussion on the potential of rare earth elements for self-healing, tunable and multifunctional coatings. Considers the cost and availability of the rare earths and the potential health and environmental risks associated with extracting them.

A New Era for Microbial Corrosion Mitigation Using Nanotechnology - Basma A. Omran 2020-07-16

This book focuses on corrosion and microbial corrosion, providing solutions for these problems based on nanotechnology and nanobiotechnology. It introduces the causes, consequences, cost and control of corrosion processes. It gives a particular emphasis on microbial corrosion of steel and other metals in oil, gas and shipping industries. The book presents the materials vulnerable to such kind of corrosion, and the use of nanomaterials to control it.

Handbook of Smart Coatings for Materials Protection - Abdel Salam Hamdy Makhlouf 2014-02-22

A smart coating is defined as one that changes its properties in response to an environmental stimulus. The Handbook of Smart Coatings for Materials Protection reviews the new generation of smart coatings for corrosion and other types of material protection. Part one explores the fundamentals of smart coatings for materials protection including types, materials, design, and processing. Chapters review corrosion processes and strategies for prevention; smart coatings for corrosion protection; techniques for synthesizing and applying smart coatings; multi-functional, self-healing coatings; and current and future trends of protective coatings for automotive, aerospace, and military applications.

Chapters in part two focus on smart coatings with self-healing properties for corrosion protection, including self-healing anticorrosion coatings for structural and petrochemical engineering applications; smart self-healing coatings for corrosion protection of aluminum alloys, magnesium alloys and steel; smart nanocoatings for corrosion detection and control; and recent advances in polyaniline-based organic coatings for corrosion protection. Chapters in part three move on to highlight other types of smart coatings, including smart self-cleaning coatings for corrosion protection; smart polymer nanocomposite water- and oil-repellent coatings for aluminum; UV-curable organic polymer coatings for corrosion protection of steel; smart epoxy coatings for early detection of corrosion in steel and aluminum; and structural ceramics with self-healing properties. The Handbook of Smart Coatings for Materials Protection is a valuable reference for those concerned with preventing corrosion, particularly of metals, professionals working within the surface coating industries, as well as all those with an academic research interest in the field. Reviews the new generation of smart coatings for corrosion and other types of material protection Explores the fundamentals of smart coatings for materials protection including types, materials, design, and processing Includes a focus on smart coatings with self-healing properties for corrosion protection

Encyclopedia of Renewable and Sustainable Materials - 2020-01-09

Encyclopedia of Renewable and Sustainable Materials provides a comprehensive overview, covering research and development on all aspects of renewable, recyclable and sustainable materials. The use of renewable and sustainable materials in building construction, the automotive sector, energy, textiles and others can create markets for agricultural products and additional revenue streams for farmers, as well as significantly reduce carbon dioxide (CO₂) emissions, manufacturing energy requirements, manufacturing costs and waste. This book provides researchers, students and professionals in materials science and engineering with tactics and information as they face increasingly complex challenges around the development,

selection and use of construction and manufacturing materials. Covers a broad range of topics not available elsewhere in one resource Arranged thematically for ease of navigation Discusses key features on processing, use, application and the environmental benefits of renewable and sustainable materials Contains a special focus on sustainability that will lead to the reduction of carbon emissions and enhance protection of the natural environment with regard to sustainable materials

Synthetic Engineering Materials and Nanotechnology - Ibrahim M. Alarifi 2021-10-29

Synthetic Engineering Materials and Nanotechnology covers the latest research and developments of synthetic processes, materials, applications and technologies. In addition, innovations in synthetic engineering materials techniques are analyzed. Each chapter addresses key concepts, properties and applications of important categories of synthetic materials, including metals alloys, polymers, composites, rubbers, oils and foams. Advances in nanomaterials produced by synthetic engineering methods are also considered, including ceramic, carbon, metal oxide, composite, and membrane-derived nanomaterials. The primary synthetic engineering materials techniques covered include thermo-mechanical, chemical, physiochemical, electrochemical, bottom-up, hybrid and biological methods. This book is suitable for early career researchers in academia and R&D in areas such as materials science and engineering, mechanical engineering and chemical engineering. Provides the fundamentals on materials produced through synthetic engineering methods, including their properties, experimental and characterization techniques, and applications Reviews the advances of synthetic engineering methods for nanomaterials applications, including electrospinning, atomic layer deposition, ion implantation, bottom-up, hybrid strategies, and more Includes numerous, real-world examples and case studies to apply the fundamental concepts to experiments and real-world applications

Nanoscale Electrochemistry - Andrew J. Wain 2021-09-14

Nanoscale Electrochemistry focuses on

challenges and advances in electrochemical nanoscience at solid-liquid interfaces, highlighting the most prominent developments of the last decade. Nanotechnology has had a tremendous effect on the multidisciplinary field of electrochemistry, yielding new fundamental insights that have broadened our understanding of interfacial processes and stimulating new and diverse applications. The book begins with a tutorial chapter to introduce the principles of nanoscale electrochemical systems and emphasize their unique behavior compared with their macro/microscopic counterparts. Building on this, the following three chapters present analytical applications, such as sensing and electrochemical imaging, that are familiar to the traditional electrochemist but whose extension to the nanoscale is nontrivial and reveals new chemical information. The subsequent three chapters present exciting new electrochemical methodologies that are specific to the nanoscale, including "single entity"-based methods and surface-enhanced electrochemical spectroscopy. These techniques, now sufficiently mature for exposition, have paved the way for major developments in our understanding of solid-liquid interfaces and continue to push electrochemical analysis toward atomic-length scales. The final three chapters address the rich overlap between electrochemistry and nanomaterials science, highlighting notable applications in energy conversion and storage. This is an important reference for both academic and industrial researchers who are seeking to learn more about how nanoscale electrochemistry has developed in recent years. Outlines the major applications of nanoscale electrochemistry in energy storage, spectroscopy and biology Summarizes the major principles of nanoscale electrochemical systems, exploring how they differ from similar system types Discusses the major challenges of electrochemical analysis at the nanoscale

Production, Properties, and Applications of High Temperature Coatings - Pakseresht, Amir Hossein 2018-01-12

Heat resistant layers are meant to withstand high temperatures while also protecting against all types of corrosion and oxidation. Therefore, the micro-structure and behavior of such layers is essential in understanding the functionality of

these materials in order to make improvements. *Production, Properties, and Applications of High Temperature Coatings* is a critical academic publication which examines the methods of creation, characteristics, and behavior of materials used in heat resistant layers. Featuring coverage on a wide range of topics such as, thermal spray methods, sol-gel coatings, and surface nanoengineering, this book is geared toward students, academicians, engineers, and researchers seeking relevant research on the methodology and materials for producing effective heat resistant layers.

Laser Surface Modification of Alloys for Corrosion and Erosion Resistance - C T Kwok
2012-03-20

Corrosion and erosion processes often occur synergistically to cause serious damage to metal alloys. Laser surface modification techniques such as laser surface melting or alloying are being increasingly used to treat surfaces to prevent corrosion or repair corroded or damaged components. Laser surface modification of alloys for corrosion and erosion resistance reviews the wealth of recent research on these important techniques and their applications. After an introductory overview, part one reviews the use of laser surface melting and other techniques to improve the corrosion resistance of stainless and other steels as well as nickel-titanium and a range of other alloys. Part two covers the use of laser surface modification to prevent different types of erosion, including liquid impingement, slurry (solid particle) and electrical erosion as well as laser remanufacturing of damaged components. With its distinguished editor and international team of contributors, Laser surface modification of alloys for corrosion and erosion resistance is a standard reference for all those concerned with preventing corrosion and erosion damage in metallic components in sectors as diverse as energy production and electrical engineering. Reviews recent research on the use of laser surface modification techniques, including the prevention of corrosion and repair of corroded or damaged components Discusses the techniques for improving the corrosion resistance of steels, nickel-titanium and a range of alloys Analyses the use of laser surface modification to prevent different types of

erosion, including liquid impingement and laser remanufacturing of damaged components
Advanced Polymeric Materials for Sustainability and Innovations - Sajith Thottathil 2018-10-01

This informative volume discusses recent advancements in the research and development in synthesis, characterization, processing, morphology, structure, and properties of advanced polymeric materials. With contributions from leading international researchers and professors in academic, government and industrial institutions, *Advanced Polymeric Materials for Sustainability and Innovations* has a special focus on eco-friendly polymers, polymer composites, nanocomposites, and blends and materials for traditional and renewable energy. In this book the relationship between processing-morphology-property applications of polymeric materials is well established. Recent advances in the synthesis of new functional monomers has shown strong potential in generating better property polymers from renewable resources. Fundamental advances in the field of nanocomposite blends and nanostructured polymeric materials in automotive, civil, biomedical and packaging/coating applications are the highlights of this book.

Oxide Dispersion Strengthened Refractory Alloys
- Anshuman Patra 2022-05-19

Refractory metals such as W, Mo, Ta, Nb, and Re have immense potential for application in plasma-facing materials in nuclear reactors, defense materials, aviation counterweights, heating elements in furnaces, and so forth. This book presents a wide perspective of oxide dispersion strengthened refractory alloys fabrication and critical properties. It provides a comprehensive road map for an appropriate basis for alloy design, process parameter selection, fabrication route, and deformation behavior for oxide dispersion strengthened refractory alloys. It further covers achievement of application-oriented properties and critical process-regulating parameters for development of sustainable materials. Features: Covers development of oxide dispersion strengthened sustainable material to withstand high-temperature environments Describes stimulating application-oriented final mechanical properties

Illustrates fabrication of alloys through effective route to achieve desired properties Presents in-depth explanation of deformation behavior at ambient and high temperatures Explores critical applications of the alloys in nuclear reactors, defense, and aviation sectors Oxide Dispersion Strengthened Refractory Alloys will be of interest to graduate students and researchers in high-temperature materials, mechanics, metallurgy, powder metallurgy, and physical metallurgy.

Modified Nanomaterials for Environmental Applications - Onoyivwe Monday Ama
2021-11-16

This book focuses on the electrochemical and nanostructural properties of new photoanode/electrolyte combinations used in the development of novel surface-modified nanomaterials for environmental applications. As water treatment is rapidly becoming a global challenge due to the increasing complexity and number of the various pollutants present, the book explores fundamental issues relating to environmental applications of nanomaterials. It addresses relevant topics ranging from electrochemical synthesis and characterization, to applications of photoanodes in corrosion prevention and biosensors for wastewater treatment. Featuring up-to-date experimental results on nanomaterials for detection of pharmaceuticals and heavy metals in wastewater, this contributed volume is useful to electrochemical researchers, materials scientists, and chemical and civil engineers interested in advanced photoelectrochemical research for environmental applications.

Nanomaterials-Based Coatings - Phuong Nguyen Tri 2019-05-30

Nanomaterials-Based Coatings: Fundamentals and Applications presents the fundamental concepts and applications of nanomaterial-based coatings in anticorrosion, antiwear, antibacterial, antifungal, self-cleaning, superhydrophobic, super hard, super heat resistance, solar reflective, photocatalytic and radar absorbing coatings. It is an important resource for those seeking to understand the underlying phenomenal and fundamental mechanisms through which nanoparticles interact with polymeric and metallic matrices to create stronger coatings. As nanomaterials-enforced coatings are smarter, stronger and more durable, the information listed in this book will help readers understand their usage and further applications. Highlights the latest methods in design, preparation and characterization techniques for nanomaterials-based coatings Discusses emerging applications of nanomaterials-based coatings, including substrates protection, sustainable energy, and in the environment and healthcare Assesses the major challenges in making nanomaterials-based coatings more reliable and cost-effective

Handbook of Modern Coating Technologies - Mahmood Aliofkhaezrai 2021-03-06

Handbook of Modern Coating Technologies: Advanced Characterization Methods reviews advanced characterization methods of modern coating technologies. The topics in this volume consist of scanning vibrating electrode technique, spectroscopic ellipsometry, advances in X-ray diffraction, neutron reflectivity, micro- and nanoprobe, fluorescence technique, stress measurement methods in thin films, micropotentiometry, and localized corrosion studies.