Thermochemical Surface Engineering Of Steels Improving Materials Performance Woodhead Publishing Series In Metals And Surface Engineering

Today's shortages of resources make the search for wear and corrosion resistant materials one of the most important tasks of the next century. Since the surface of a material is the location where any interaction occurs, it is that there the hardest requirements on the material are imposed: to be wear resistant for tools and bearings; to be corrosion resistant for turbine blades and tubes in the petrochemical industry; to be antireflecting for solar cells; to be decorative for architectural panels and to combine several of these properties in other applications. Surface engineering is the general term that incorporates all the techniques by which a surface modification can be accomplished. These techniques include both coating and modification of the surface by ion implantation and laser beam melting. In recent years a continuously growing number of these techniques were developed to the extent that it became more and more difficult to maintain an overlook and to understand which of these highly differentiated techniques might be applied to resolve a given surface engineering problem. A similar development is also occuring for surface characterization techniques. This volume contains contributions from renowned scientists and engineers to the Eurocourse the aim of which was to inform about the various techniques and to give a comprehensive survey of the latest development on this subject.

Welding and Joining of Advanced High Strength Steels (AHSS): The Automotive Industry discusses the ways advanced high strength steels (AHSS) are key to weight reduction in sectors such as automotive engineering. It includes a discussion on how welding can alter the microstructure in the heat affected zone, producing either excessive hardening or softening, and how these local changes create potential weaknesses that can lead to failure. This text reviews the range of welding and other joining technologies for AHSS and how they can be best used to maximize the potential of AHSS. Reviews the properties and manufacturing techniques of advanced high strength steels (AHSS) Examines welding processes, performance, and fatigue in AHSS Focuses on AHSS welding and joining within the automotive industry

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

This book is intended to help engineers analyze service condition and potential mechanisms of surface degradation. This will enable engineers select suitable materials for improved service-life and performance of engineering components. The book comprises 7 chapters, and is well illustrated with schematics, photographs, microstructure, XRD patterns, EDAX mapping, and technical data tables. The book focuses on the influence of materials and methods of surface engineering on structure, properties, and wear-performance of engineering components. It begins with the need to study the subject of surface engineering, scope of surface engineering, and classification of techniques of surface engineering. The book covers conventional material system (steel, cast iron, stellite, WC-Co, PCDs, etc.) and new materials like multilayer structures, functionally gradient materials (FGMs), intermetallic barrier coatings, and thermal barrier coating. The book covers most conventional as well as advanced surface engineering techniques, such as burnishing, shot peening, flame and induction hardening, laser and electron beam hardening, plasma and TIG melting, carburizing, nitriding, cyaniding, boronizing, vanadizing, ion implantation, laser alloying, chemical vapor deposition, PE chemical vapor deposition, physical vapor deposition, weld overlays, laser cladding, hot dip galvanizing, hot dip lead tin coating, hot dip aluminizing, hot dip chromizing, electroplating, electroless plating (Ni-P and Ni-B), mechanical plating, roll bonding, explosive bonding, and hot isostatic. The book also includes an introductory chapter on friction-stir processing of aluminum and titanium alloys. Further, it discusses studies on structure, mechanical and wear properties of weld surfacing, flame spray coating, HVOF sprayed coating, laser cladding of ferrous metals, nickel and cobalt based alloys and their composites in as-sprayed and heat-treated conditions. The book provides a comprehensive overview of various destructive and nondestructive techniques used for characterization of engineered surfaces. The materials in the book will be useful to undergraduate and graduate students. In addition, the contents of this book can also be used for professional development courses for practicing engineers.

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

Finish Manufacturing Processes are those final stage processing techniques which are deployed to bring a product to readiness for marketing and putting in service. Over recent decades a number of finish manufacturing processes have been newly developed by researchers and technologists. Many of these developments have been reported and illustrated in existing literature in a piecemeal manner or in relation only to specific applications. For the first time, Comprehensive Materials Finishing integrates a wide body of this knowledge and understanding into a single, comprehensive work. Containing a mixture

of review articles, case studies and research findings resulting from R & D activities in industrial and academic domains, this reference work focuses on how some finish manufacturing processes are advantageous for a broad range of technologies. These include applicability, energy and technological costs as well as practicability of implementation. The work covers a wide range of materials such as ferrous, non-ferrous and polymeric materials. There are three main distinct types of finishing processes: Surface Treatment by which the properties of the material are modified without generally changing the physical dimensions of the surface; Finish Machining Processes by which a small layer of material is removed from the surface by various machining processes to render improved surface characteristics; and Surface Coating Processes by which the surface properties are improved by adding fine layer(s) of materials with superior surface characteristics. Each of these primary finishing processes is presented in its own volume for ease of use, making Comprehensive Materials Finishing an essential reference source for researchers and professionals at all career stages in academia and industry. Provides an interdisciplinary focus, allowing readers to become familiar with the broad range of uses for materials finishing Brings together all known research in materials finishing in a single reference for the first time Includes case studies that illustrate theory and show how it is applied in practice

Chemical vapor deposition (CVD) techniques have played a major role in the development of modern technology, and the rise of nanotechnology has further increased their importance, thanks to techniques such as atomic layer deposition (ALD) and vapor liquid solid growth, which are able to control the growth process at the nanoscale. This book aims to contribute to the knowledge of recent developments in CVD technology and its applications. To this aim, important process innovations, such as spatial ALD, direct liquid injection CVD, and electron cyclotron resonance CVD, are presented. Moreover, some of the most recent applications of CVD techniques for the growth of nanomaterials, including graphene, nanofibers, and diamond-like carbon, are described in the book.

Austenitic stainless steels lend themselves to a wide range of applications. However, they normally stiffer from poor wear resistance and do not respond well to traditional surface treatments. This volume. the fruit of a current status seminar, reflects the enormous strides which have been made in the last few years in the study of the expanded austenite phase (also called the S phase) and the development of new surface treatment techniques. As well as the papers presented at the seminar, the book contains selection from related papers and a comprehensive bibliography of the literature on the subject from 1979 to 2000.

Material Properties of Steel Fire Conditions is a major new contribution on how to understand the material properties of steel in fires. The application of new types of steel and development of sophisticated codes of practice has grown dramatically in recent years, making this a timely resource on the topic. Under fire conditions, knowing the material properties of steel is essential in the fire resistance design of steel structures, such as in Eurocode3. This book shows that the reduction factors of mechanical properties of different steels are quite different. In recent years, the authors of this book have carried out significant testing on the material properties of several types of steels, such as Q460 steel, Q690 steel and A992 steel, etc. Users will find this new test data on the material properties of steel with temperature useful in evaluating the fire resistance of steel structures in their own projects. Deals with the material properties of steels in fire conditions, including thermal properties and mechanical properties, such as thermal conductivity, strength, elastic modulus and creep behavior Provides basic knowledge to perform fire resistance design of steel structures Presents information useful to designers, researches and students who must conduct fire resistance design or perform structural analyses on high strength steel structures

The operation of numerous components that are critical to safety in industries around the world relies on protective coatings. These coatings often allow process equipment to serve a purpose in environments well beyond the operational limit of the uncoated components. Durability, ease of application, repairability, reliability and long-term performance of such coatings are all key to their application. Therefore, this book, Coatings for Harsh Environments, is devoted to research and review articles on the metallic, non-metallic and composite coatings used in aggressive environments. In particular, the topics of interest include, but are not limited to: coatings for high temperature and molten salt applications; thermal spray and cold spray coatings for aggressive environments; corrosion, wear and cavitation resistant coatings; coatings for mitigating marine corrosion; coatings for chemical and petrochemical plants; thermal barrier coatings.

Tribology is a multidisciplinary science that encompasses mechanical engineering, materials science, surface engineering, lubricants, and additives chemistry with tremendous applications. Tribology and Surface Engineering for Industrial Applications discusses the latest in tribology and surface engineering for industrial applications. This book: Offers information on coatings and surface diagnostics Explains a variety of techniques for improved performance Describes applications in automotive, wheel and rail materials, manufacturing, and wind turbines Written for researchers and advanced students, this book encompasses a wide-ranging view of the latest in industrial applications of tribology and surface engineering for a variety of cross-disciplinary applications.

This volume, the fruit of a current status seminar, reflects the enormous strides which have been made in the last few years in the study of the expanded austenite phase (also called the S phase) and the development of new surface treatment techniques. The book also contains a selection from related papers and a comprehensive bibliography of the literature on the subject from 1979 to 2000.

This title is designed to provide a clear and comprehensive overview of tribology. The book introduces the notion of a surface in tribology where a solid surface is described from topographical, structural, mechanical, and energetic perspectives. It also describes the principal techniques used to characterize and analyze surfaces. The title then discusses what may be called the fundamentals of tribology by introducing and describing the concepts of adhesion, friction, wear, and lubrication. The book focuses on the materials used in tribology, introducing the major classes of materials used, either in their bulk states or as coatings, including both protective layers and other coatings used for decorative purposes. Of especial importance to the tribology community are sections that provide the latest information on Nanotribology, Wear, Lubrication, and Wear-Corrosion: Tribocorrosion and Erosion-Corrosion.

Thermochemical surface engineering significantly improves the properties of steels. Edited by two of the world's leading authorities, this important book summarises the range of techniques and their applications. It covers nitriding, nitrocarburizing and carburizing. There are also chapters on low temperature techniques as well as boriding, sheradizing, aluminizing, chromizing, thermo-reactive deposition and diffusion. Reviews the fundamentals of surface treatments and current performance of improved materials Covers nitriding, nitrocarburizing and carburizing of iron and iron carbon alloys Examines how different thermochemical surface engineering methods can help against corrosion

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.

This thesis is devoted towards physical vapor deposition (PVD) of thin films of transition-metal (TM) diborides, focused on the material system TiBx, Ti1-xAlxB2-y and CrBx. The metal diborides are a large family of compounds with both metallic and ceramic properties, due to its bonding nature being a mix of covalent and ionic bonds. Their characteristics include, e.g., good mechanical, electrical and thermal properties, while an improved oxidation and corrosion resistance are currently sought after. Furthermore, while the ideal composition of these diborides is TMB2, i.e. with a B to metal ratio of 2, the stoichiometry in the PVD deposited films typically diverges from this ratio. TiBx is often reported to be overstoichiometric, with x well above 2. One of the most known and commonly used member of the TM diboride family is TiBx, primarily used in hard-coating applications such as tools for machining Al. However, the material displays a fracture toughness and oxidation resistance that ideally needs to be improved. The films presented in this thesis were deposited by high power impulse magnetron sputtering (HiPIMS) and direct current magnetron sputtering (DCMS). Using both methods facilitates an improved control of both microstructure and composition, and hence the materials properties. With HiPIMS, understoichiometric TiBx films were grown and it was shown that these films can match and even exceed the overstoichiometric counterpart, deposited with DCMS, in terms of mechanical properties. The hardness and fracture toughness for TiB1.43 films were measured at 43.9±0.9 GPa and 4.2±0.1 MPa?m, compared to TiB2.70 films at 37.7±0.8 GPa and 3.1±0.1 MPa?m. Furthermore, the understoichiometric films significantly improve the oxidation resistance. Air annealing of TiB1.43, TiB2.20, and TiB2.70 films at 400 °C showed an average oxidation rate of 2.9±1.5, 7.1±1.0, and 20.0±5.0 nm/h, respectively, explained by the microstructural difference between over- and understoichiometric material. In TiBx films where x > 2, there is a B-rich tissue phase in the grain boundaries which is suggested to enhance oxidation. The hydroscopic nature of B2O3 causes more rapid oxidation and evaporation thus providing an easy oxidation pathway in B-rich regions. However, understoichiometric films where x 2), vilket i sin tur påverkar beständigheten mot oxidering negativt. Med hjälp av HiPIMS kan man kontrollera stökiometrin av filmen i större grad, och kan således generera understökiometrisk TiBx (x This book presents the proceedings of the International Conference on Residual Stresses 10 and is devoted to the prediction/modelling, evaluation, control, and application of residual stresses in engineering materials. New developments, on stress-measurement techniques, on modelling and prediction of residual stresses and on progress made in the fundamental understanding of the relation between the state of residual stress and the material properties, are highlighted. The proceedings offer an overview of the current understanding of the role of residual stresses in materials used in wide ranging application areas.

This highly illustrated reference work covers the three principal types of surface technologies that best protect engineering devices and products: diffusion technologies, deposition technologies, and other less commonly acknowledged surface engineering (SE) techniques. Various applications are noted throughout the text and additionally whole chapters are devoted to specific SE applications across the automotive, gas turbine engine (GTE), metal machining, and biomedical implant sectors. Along with the benefits of SE, this volume also critically examines SE's limitations. Materials degradation pathways - those which can and those which cannot be mitigated by SE - are rigorously explained. Written from a scientific, materials engineering perspective, this concise text is supported by high-quality images and photo-micrographs which show how surfaces can be engineered to overcome the limits of conventionally produced materials, even in complex or hostile operating environments. This book is a useful resource for undergraduate and postgraduate students as well as professional engineers.

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

Annotation A practical selection guide to help engineers and technicians choose the mot efficient surface hardening techniques that offer consistent and repeatable results. Emphasis is placed on characteristics such as processing temperature, case/coating thickness, bond strength, and hardness level obtained. The advantages and limitations of the various thermochemical, thermal and coating/surface modification technologies are compared

These Proceedings provide a picture of the current knowledge and technology of heat treatment and surface engineering. Most recent developments concerning the thermodynamics and kinetics of the underlying processes are presented here. Special emphasis is placed on process control and computer modelling.

This book focuses on the effect of plasma nitriding on the properties of steels. Parameters of different grades of steels are considered, such as structural and constructional steels, stainless steels and tools steels. The reader will find within the text an introduction to nitriding treatment, the basis of plasma and its roll in nitriding. The authors also address the advantages and disadvantages of plasma nitriding in comparison with other nitriding methods.

An Introduction to Surface Alloying of Metals aims to serve as a primer to the basic aspects of surface alloying of metals. The book serves to elucidate fundamentals of surface modification and their engineering applications. The book starts with basics of surface alloying and goes on to cover key surface alloying methods, such as carburizing, nitriding, chromizing, duplex treatment and the characterization of surface layers. The book will prove useful to students at both the undergraduate and graduate levels, as also to researchers and practitioners looking for a quick introduction to surface alloying.

Following a general introduction, which reviews steelmaking practices as well as the classification, general properties, and applications of steel, this volume contains four major sections that describe processing characteristics, service characteristics, corrosion behavior, and material requirement

The book covers very important issues, not only scientific in nature but, ultimately, for industry and the economy. Wear and deterioration of surface properties during operation is a natural and unavoidable phenomenon. However, minimizing the degree of wear is of great importance for the entire economy, as illustrated by the example of the US economy, for which the loss of natural resources as a direct cause of friction and wear exceeds 6% of the Gross National Product. This book showcases the valuable knowledge revealed from both theoretical and practical research results in the field of advanced technologies of coatings and surface modification, as well as wear and tribological characteristics of advanced materials and surface layers. Therefore, it is hoped that this book will be a valuable resource and helpful tool for scientists, engineers, and students in the field of surface engineering, materials science, and manufacturing engineering.

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

Surface Engineering of Metals provides basic definitions of classical and modern surface treatments, addressing mechanisms of formation, microstructure, and properties of surface layers. Part I outlines the fundamentals of surface engineering, presents the history of its development, and proposes a two-category classification of surface layers. Discussions include the basic potential and usable properties of superficial layers and coatings, explaining their concept, interaction with other properties, and the significance of these properties for proper selection and functioning. Part II provides an original classification of the production methods of surface layers. Discussions include the latest technologies in this field, characterized by directional or beam interaction of particles or of the heating medium with the treat surface.

Properties, Specifications and Applications: Covering the subject of steel metallurgy from its applications point of view, this book discusses the applied metallurgical knowledge required for easy-learning about steels, their properties, specifications, heat treatment and applications. : The book is conceptually divided into four parts: ÿThe first part introduces the basic metallurgical facts about steel and its characteristics, covers the most important aspects of steel metallurgy, its applications, and fundamental features of steelmaking and rolling processes, and highlights the different types of properties of steel and the need for testing and evaluation: ÿDiscussing the classifications, specifications and properties of steels in a more quantitative manner (based on popular standards and standard-based data), the second part focuses on different steel grades and their merits and properties for selection and applications ÿThe third part focuses on heat treatment and welding of steels, various heat treatment methods and their purposes, and basic aspects of welding and welding precautions in steels ÿDwelling on the application of steels, the fourth part discusses the totality of steel applications from the point of view of reliability and component integrity, the importance of cost and quality optimization in applications, and the criticality of design and manufacturing quality for prevention of failures Steel Metallurgy has been designed to provide all necessary information and practice-based knowledge about steel characteristics, steel properties, steel grades, and steel applications for selecting, processing and using steels with right understanding and for the right purposes.ÿ Highlights of the book: ÿProvides deep theoretical and practice-based knowledge about steels, their properties, specifications, heat treatment and applications ÿIncludes large number of examples, illustrations and case studies ÿIncludes elaborate Index of contents for cross-referencing, a Bibliography for further reading and reference, and Glossary of Important Metallurgical Terms ÿSimplified and highly illustrated narration ideal for metallurgical students, metallurgists and non-metallurgical engineers The book is intended for both students and practitioners. The book will help students of metallurgy and other engineering disciplines to understand the applied and functional-basics of steels relating to their properties, specifications and applications. Engineers and technical personnel in industries dealing with steel processing and its uses will benefit from the hard look the book takes for the precise selection of steel for the right purposes by providing workable knowledge on steel metallurgy and steel specifications. ÿ

Research in the area of nanoindentation has gained significant momentum in recent years, but there are very few books currently available which can educate researchers on the application aspects of this technique in various areas of materials science. Applied Nanoindentation in Advanced Materials addresses this need and is a comprehensive, self-contained reference covering applied aspects of nanoindentation in advanced materials. With contributions from leading researchers in the field, this book is divided into three parts. Part one covers innovations and analysis, and parts two and three examine the application and evaluation of soft and ceramic-like materials respectively. Key features: A one stop solution for scholars and researchers to learn applied aspects of nanoindentation Contains contributions from leading researchers in the field Includes the analysis of key properties that can be studied using the nanoindentation technique Covers recent innovations Includes worked examples Applied Nanoindentation in Advanced Materials is an ideal reference for researchers and practitioners working in the areas of nanotechnology and nanomechanics, and is also a useful source of information for graduate students in mechanical and materials engineering, and chemistry. This book also contains a wealth of information for scientists and engineers interested in mathematical modelling and simulations related to nanoindentation testing and analysis.

This book presents the most important thermochemical and physical techniques of boriding. The formation and characterization of different boride layers or boride coatings are

compared in this book. The author analyzes the technological aspects of boriding processes, presenting the advantages and disadvantages of each method. The effect of the boriding techniques on the microstructure of borided materials are also indicated. The mechanism of formation of active boron atoms or ions and the phenomena during re-melting of alloying material together with the substrate are described. Special attention is devoted to powder-pack boriding, electrochemical boriding in borax, gas boriding, plasma gas or paste boriding and laser or plasma surface alloying with boron, acknowledged as the most important current methods in boriding. The thermodynamics of gas boriding is also analyzed.

Surface Engineering: Processes and Applications: This volume covers both innovative and basic methods of surface engineering for improved surface properties.

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

This book offers a strong introduction to fundamental concepts on the basis of materials science. It conveys the central issue of materials science, distinguishing it from merely solid state physics and solid state chemistry, namely to develop models that provide the relation between the microstructure and the properties. The book is meant to be used in the beginning of a materials science and engineering study as well as throughout an entire undergraduate and even graduate study as a solid background against which specialized texts can be studied. Topics dealt with are "crystallography", "lattice defects", "microstructural analysis", "phase equilibria and transformations" and "mechanical strength". After the basic chapters the coverage of topics occurs to an extent surpassing what can be offered in a freshman's course. About the author Prof. Mittemeijer is one of the top scientists in materials science, whose perceptiveness and insight have led to important achievements. This book witnesses of his knowledge and panoramic overview and profound understanding of the field. He is a director of the Max Planck Institute for Metals Research in Stuttgart.

The first of many important works featured in CRC Press' Metals and Alloys Encyclopedia Collection, the Encyclopedia of Iron, Steel, and Their Alloys covers all the fundamental, theoretical, and application-related aspects of the metallurgical science, engineering, and technology of iron, steel, and their alloys. This Five-Volume Set addresses topics such as extractive metallurgy, powder metallurgy and processing, physical metallurgy, production engineering, corrosion engineering, thermal processing, metalworking, welding, iron- and steelmaking, heat treating, rolling, casting, hot and cold forming, surface finishing and coating, crystallography, metallography, computational metallurgy, metal-matrix composites, intermetallics, nano- and micro-structured metals and alloys, nano- and micro-alloying effects, special steels, and mining. A valuable reference for materials scientists and engineers, chemists, manufacturers, miners, researchers, and students, this must-have encyclopedia: Provides extensive coverage of properties and recommended practices Includes a wealth of helpful charts, nomograms, and figures Contains cross referencing for quick and easy search Each entry is written by a subject-matter expert and reviewed by an international panel of renowned researchers from academia, government, and industry. Also Available Online This Taylor & Francis encyclopedia is also available through online subscription, offering a variety of extra benefits for researchers, students, and librarians, including: Citation tracking and alerts Active reference linking Saved searches and marked lists HTML and PDF format options Contact Taylor and Francis for more information or to inquire about subscription options and print/online combination packages. US: (Tel) 1.888.318.2367; (E-mail) e-reference@taylorandfrancis.com International: (Tel) +44 (0) 20 7017 6062; (E-mail) online.sales@tandf.co.uk

Surface engineering is a multidisciplinary action intended to identify the properties of the surfaces of engineering mechanism in order to improve their function and serviceability. Corrosion, wear and fatigue are among the most important mechanisms that lead to materials degradation, which, eventually, leads to failure of components. Thus there is a great potential for saving resources, provided that the fundamentals of material behavior, and thus its performance including degradation, are understood, in order to define on that basis strategies to improve the intrinsic properties of materials. Carbon steel is commonly used in the industry but vulnerable to wear and corrosion in the field. Replacing it with stainless or alloy steel increases the cost significantly, and a better alternative is to improve its surface properties and lifetime using plasma immersion ion implantation.Thermochemical Surface Engineering of Steels deals with the treatment of the surface and near-surface regions of steel to allow the surface to perform functions that are distinct from those functions demanded from the bulk of the material. It deals with geometrical, optical and chemical properties of stainless steel surfaces polished by various methods. It highlights on nitriding thermochemical surface treatment used in steels and alloys to improve wear and friction properties by surface microstructure

modification, while maintaining adequate substrate properties. Surface characterization and corrosion resistance of 36Cr-Ni-Mo4 Steel Coated by WC-Co cermet electrode is explained. Effect of heat treatment parameters on the mechanical and microstructure properties of low-alloy steel and effects of gas metal arc welding techniques on the mechanical properties of duplex stainless steel are discussed as well. It is hoped that this book will be of valuable for engineers and practitioners as well as for researchers and will inspire young people to donate to future growth in the field.