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Papers presented at the Seventeenth International Symposium on Processing and Fabrication of Advanced Material XVII, held at New Delhi during 15-17 December 2008. Gas turbine engines will still represent a key technology in the next 20-year energy scenarios, either in stand-alone applications or in combination with other power generation equipment. This book intends in fact to provide an updated picture as well as a perspective vision of some of the major improvements that characterize the gas turbine technology in different applications, from marine and aircraft propulsion to industrial and stationary power generation. Therefore, the target audience for it involves design, analyst, materials and maintenance engineers. Also manufacturers, researchers and scientists will benefit from the timely and accurate information provided in this volume. The book is organized into five main sections including 21 chapters overall: (I) Aero

and Marine Gas Turbines, (II) Gas Turbine Systems, (III) Heat Transfer, (IV) Combustion and (V) Materials and Fabrication. Provides a methodology for integrating materials selection with the design process, including simultaneous technical and economic evaluation. Save hours of frustrating research time: Get fast answers about the best material for a particular application. In the past, researching the endless sources on corrosion and materials in their countless applications were next to impossible. That's why this book was written: to help simplify your materials selection problems. It's an exhaustive source on the different corrosion-resistant materials, types of corrosion, factors affecting corrosion, passivation, corrosion monitoring, corrosion control measures, methodology of materials selection, and more. This book is a comprehensive guide to the compositions, properties, processing, performance, and applications of nickel, cobalt, and their alloys. It includes all of the essential information contained in the ASM Handbook series, as well as new or updated coverage in many areas in the nickel, cobalt, and related industries. This handbook is a comprehensive guide to the selection and applications of copper and copper alloys, which constitute one of the largest and most diverse families of engineering materials. The handbook includes all of the essential information contained in the ASM Handbook series, as well as important reference information and data from a wide variety of ASM publications and industry sources. Materials in Marine Technology covers the important aspects of metallurgy and materials engineering which must be taken into account when designing for marine environments. The purpose is to aid materials selection and the incorporation of materials data into the design, manufacture and inspection strategy. Recent advances in materials technology, including the use of new materials for marine applications Alloys, Polymers and Composites are examined in detail. The integrated approach is design oriented and is supported by recent case studies. Proceedings of the IUTAM Symposium held in Abisko National Park, Kiruna, Sweden, July 31-August 4, 2000 Containing papers presented at the Seventh International Conference on Materials Characterisation, this book presents

the latest advances in a rapidly developing field that requires the application of a combination of numerical and experimental methods. The work has been contributed by researchers who use computational methods, those who perform experiments, and those who combine both. Materials characterisation is important to ensuring that new products meet the needs of industry and consumers. The accurate characterisation of the physical and chemical properties of the materials requires the application of both experimental techniques and computer simulation methods. The wide range of materials now available, from metals to polymers and semiconductors to composites, necessitates a variety of experimental techniques and numerical methods. The papers in the book examine various combinations of techniques. The papers cover such topics as: Mechanical Characterisation and Testing; Micro and Macro Materials Characterisation; Cementitious Materials; Advances in Composites; Semiconductor Materials Characterisation; Computational Models and Experiments; Corrosion Problems. This book evaluates the latest developments in nickel alloys and high-alloy special stainless steels by material number, price, wear rate in corrosive media, mechanical and metallurgical characteristics, weldability, and resistance to pitting and crevice corrosion. Nickel Alloys is at the forefront in the search for the most economic solutions to c The use of high-temperature materials in current and future applications, including silicone materials for handling hot foods and metal alloys for developing high-speed aircraft and spacecraft systems, has generated a growing interest in high-temperature technologies. High Temperature Materials and Mechanisms explores a broad range of issues related to high-temperature materials and mechanisms that operate in harsh conditions. While some applications involve the use of materials at high temperatures, others require materials processed at high temperatures for use at room temperature. High-temperature materials must also be resistant to related causes of damage, such as oxidation and corrosion, which are accelerated with increased temperatures. This book examines high-temperature materials and

mechanisms from many angles. It covers the topics of processes, materials characterization methods, and the nondestructive evaluation and health monitoring of high-temperature materials and structures. It describes the application of high temperature materials to actuators and sensors, sensor design challenges, as well as various high temperature materials and mechanisms applications and challenges. Utilizing the knowledge of experts in the field, the book considers the multidisciplinary nature of high temperature materials and mechanisms, and covers technology related to several areas including energy, space, aerospace, electronics, and metallurgy. Supplies extensive references at the end of each chapter to enhance further study Addresses related science and engineering disciplines Includes information on drills, actuators, sensors and more A comprehensive resource of information consolidated in one book, this text greatly benefits students in materials science, aerospace and mechanical engineering, and physics. It is also an ideal resource for professionals in the industry. A current and comprehensive treatment of tribology theory and applications A solid understanding of tribology is essential for engineers in many fields working to design and ensure the reliability of machine parts and systems. Principles and Applications of Tribology is the first truly broad-based book on this vital subject. Moving from basic theory to practice, it examines tribology from the integrated viewpoint of mechanical engineering, mechanics, and materials science. It offers detailed coverage of the mechanisms of material wear, friction, and all of the major lubrication techniques--liquids, solids, and gases-- and examines a wide range of both traditional and state-of-the-art applications. Based on the author's extensive research and teaching experience in the areas of tribology, mechanics, and materials science for more than thirty years, this book emphasizes a contemporary knowledge of tribology that includes the emerging field of micro/nanotribology and various industrial applications, including cutting-edge topics such as magnetic information storage devices and microelectromechanical systems. Principles and Applications of Tribology is invaluable for mechanical, chemical, and materials

engineers involved in product and process design, as well as graduate students and researchers in these areas. Materials Science and Engineering theme is a component of Encyclopedia of Physical Sciences, Engineering and Technology Resources in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty one Encyclopedias. Materials Science and Engineering is concerned with the development and selection of the best possible material for a particular engineering task and the determination of the most effective method of producing the materials and the component. The Theme with contributions from distinguished experts in the field, discusses Materials Science and Engineering. In this theme the history of materials is traced and the concept of structure (atomic structure, microstructure and defect structure) and its relationship to properties developed. The theme is structured in five main topics: Materials Science and Engineering; Optimization of Materials Properties; Structural and Functional Materials; Materials Processing and Manufacturing Technologies; Detection of Defects and Assessment of Serviceability; Materials of the Future, which are then expanded into multiple subtopics, each as a chapter. These three volumes are aimed at the following five major target audiences: University and College students Educators, Professional practitioners, Research personnel and Policy analysts, managers, and decision makers and NGOs An October 2007 conference allowed scientists and engineers from around the world to exchange information on advanced, high-efficiency coal power plants. Papers from the conference are presented here, in sections on boilers, turbines, oxidation, creep/life management, welding, and oxy fuel. Some specific topics include materials solutions for advanced steam power plants, consideration of weld behavior in the design of high temperature components, nickel alloys for high efficiency fossil power plants, and material development and mechanical integrity analysis for advanced steam turbines. Other subjects are ferritic and austenitic grades for a new generation of steam power plants, the impact of steam-side oxidation on boiler heat-exchanger tube design, and oxy-combustion technology for utility coal-fired

boilers. Proceedings of the second international conference on heat resistant materials 11 -14 September 1995 sponsored by ASM and NACE. This second offering by the Speciality Materials Divisions Heat Resistant Materials Committee in Galtinberg, TN, focuses on material used for high temperature applications, with special emphasis on structural irons, nickel-base alloys, stainless steels and nonferrous alloys. Also covered are ceramics, intermetallics, and coatings, the proceedings address corrosion resistance, integrity of welds at high temperatures, and creep and stress corrosion cracking. Failures or forced shutdowns in power plants are often due to boilers, and particularly failure of boiler tubes. This comprehensive resource deals with the subject of failure investigation of boiler tubes from basic fundamentals to practical applications. Coverage includes properties and selection of materials for boiler tubes from a metallurgical view point, damage mechanisms responsible for failure of boiler tubes, and characterization techniques employed for investigating failures of boiler tubes in thermal power plants and utility boilers of industrial/commercial/institutional (ICI) boilers. A large number of case studies based on the actual failures from the field are described, along with photographs and microstructures to allow for easy comprehension of the theory behind the failures. This book is geared to practicing engineers and for studies in the major area of power plant engineering. For non-metallurgists, a chapter has been devoted to the basics of material science, metallurgy of steels, heat treatment, and structure-property correlation. A chapter on materials for boiler tubes covers composition and application of different grades of steels and high temperature alloys currently in use as boiler tubes and future materials to be used in supercritical, ultra-supercritical and advanced ultra-supercritical thermal power plants. A comprehensive discussion on different mechanisms of boiler tube failure is the heart of the book. Additional chapters detailing the role of advanced material characterization techniques in failure investigation and the role of water chemistry in tube failures are key contributions to the book. The authors have long-standing experience in the field of metallurgy and materials technology,

failure investigation, remaining life assessment (RLA) and fitness for service (FFS) for industrial plant and equipment, including power plants. They have conducted a large number of failure investigations of boiler tubes and have recommended effective remedial measures in problem solving for power and utility boilers. Modern gas turbine power plants represent one of the most efficient and economic conventional power generation technologies suitable for large-scale and smaller scale applications. Alongside this, gas turbine systems operate with low emissions and are more flexible in their operational characteristics than other large-scale generation units such as steam cycle plants. Gas turbines are unrivalled in their superior power density (power-to-weight) and are thus the prime choice for industrial applications where size and weight matter the most. Developments in the field look to improve on this performance, aiming at higher efficiency generation, lower emission systems and more fuel-flexible operation to utilise lower-grade gases, liquid fuels, and gasified solid fuels/biomass. Modern gas turbine systems provides a comprehensive review of gas turbine science and engineering. The first part of the book provides an overview of gas turbine types, applications and cycles. Part two moves on to explore major components of modern gas turbine systems including compressors, combustors and turbogenerators. Finally, the operation and maintenance of modern gas turbine systems is discussed in part three. The section includes chapters on performance issues and modelling, the maintenance and repair of components and fuel flexibility. Modern gas turbine systems is a technical resource for power plant operators, industrial engineers working with gas turbine power plants and researchers, scientists and students interested in the field. Provides a comprehensive review of gas turbine systems and fundamentals of a cycle Examines the major components of modern systems, including compressors, combustors and turbines Discusses the operation and maintenance of component parts Advances in Laser Materials Processing: Technology, Research and Application, Second Edition, provides a revised, updated and expanded overview of the area, covering fundamental

theory, technology and methods, traditional and emerging applications and potential future directions. The book begins with an overview of the technology and challenges to applying the technology in manufacturing. Parts Two thru Seven focus on essential techniques and process, including cutting, welding, annealing, hardening and peening, surface treatments, coating and materials deposition. The final part of the book considers the mathematical modeling and control of laser processes. Throughout, chapters review the scientific theory underpinning applications, offer full appraisals of the processes described and review potential future trends. A comprehensive practitioner guide and reference work explaining state-of-the-art laser processing technologies in manufacturing and other disciplines Explores challenges, potential, and future directions through the continuous development of new, application-specific lasers in materials processing Provides revised, expanded and updated coverage The rapidly-expanding aerospace industry is a prime developer and user of advanced metallic and composite materials in its many products. This book concentrates on the manufacturing technology necessary to fabricate and assemble these materials into useful and effective structural components. Detailed chapters are dedicated to each key metal or alloy used in the industry, including aluminum, magnesium, beryllium, titanium, high strength steels, and superalloys. In addition the book deals with composites, adhesive bonding and presents the essentials of structural assembly. This book will be an important resource for all those involved in aerospace design and construction, materials science and engineering, as well as for metallurgists and those working in related sectors such as the automotive and mass transport industries. Flake Campbell Jr has over thirty seven years experience in the aerospace industry and is currently Senior Technical Fellow at the Boeing Phantom Works in Missouri, USA. \* All major aerospace structural materials covered: metals and composites \* Focus on details of manufacture and use \* Author has huge experience in aerospace industry \* A must-have book for materials engineers, design and structural engineers, metallurgical engineers and manufacturers for

the aerospace industry **Alloying: Understanding the Basics** is a comprehensive guide to the influence of alloy additions on mechanical properties, physical properties, corrosion and chemical behavior, and processing and manufacturing characteristics. The coverage considers "alloying" to include any addition of an element or compound that interacts with a base metal to influence properties. Thus, the book addresses the beneficial effects of major alloy additions, inoculants, dopants, grain refiners, and other elements that have been deliberately added to improve performance, as well the detrimental effects of minor elements or residual (tramp) elements included in charge materials or that result from improper melting or refining techniques. The content is presented in a concise, user-friendly format. Numerous figures and tables are provided. The coverage has been weighted to provide the most detailed information on the most industrially important materials. The second edition of this well-received handbook is the most concise yet comprehensive compilation of materials data. The chapters provide succinct descriptions and summarize essential and reliable data for various types of materials. The information is amply illustrated with 900 tables and 1050 figures selected primarily from well-established data collections, such as Landolt-Börnstein, which is now part of the SpringerMaterials database. The new edition of the Springer Handbook of Materials Data starts by presenting the latest CODATA recommended values of the fundamental physical constants and provides comprehensive tables of the physical and physicochemical properties of the elements. 25 chapters collect and summarize the most frequently used data and relationships for numerous metals, nonmetallic materials, functional materials and selected special structures such as liquid crystals and nanostructured materials. Along with careful updates to the content and the inclusion of timely and extensive references, this second edition includes new chapters on polymers, materials for solid catalysts and low-dimensional semiconductors. This handbook is an authoritative reference resource for engineers, scientists and students engaged in the vast field of materials science. Valuable information on

corrosion fundamentals and applications of aluminum and magnesium Aluminum and magnesium alloys are receiving increased attention due to their light weight, abundance, and resistance to corrosion. In particular, when used in automobile manufacturing, these alloys promise reduced car weights, lower fuel consumption, and resulting environmental benefits. Meeting the need for a single source on this subject, **Corrosion Resistance of Aluminum and Magnesium Alloys** gives scientists, engineers, and students a one-stop reference for understanding both the corrosion fundamentals and applications relevant to these important light metals. Written by a world leader in the field, the text considers corrosion phenomena for the two metals in a systematic and parallel fashion. The coverage includes: The essentials of corrosion for aqueous, high temperature corrosion, and active-passive behavior of aluminum and magnesium alloys The performance and corrosion forms of aluminum alloys The performance and corrosion forms of magnesium alloys Corrosion prevention methods such as coatings for aluminum and magnesium Electrochemical methods of corrosion investigation and their application to aluminum and magnesium alloys Offering case studies and detailed references, **Corrosion Resistance of Aluminum and Magnesium Alloys** provides an essential, up-to-date resource for graduate-level study, as well as a working reference for professionals using aluminum, magnesium, and their alloys. Whether an airplane or a space shuttle, a flying machine requires advanced materials to provide a strong, lightweight body and a powerful engine that functions at high temperature. The **Aerospace Materials Handbook** examines these materials, covering traditional superalloys as well as more recently developed light alloys. Capturing state-of-the-art d Written to educate readers about recent advances in the area of new materials used in making products. Materials and their properties usually limit the component designer. \* Presents information about all of these advanced materials that enable products to be designed in a new way \* Provides a cost effective way for the design engineer to become acquainted with new materials \* The material expert benefits by being aware of the latest development in all these

areas so he/she can focus on further improvements. This resource covers all areas of interest for the practicing engineer as well as for the student at various levels and educational institutions. It features the work of authors from all over the world who have contributed their expertise and support the globally working engineer in finding a solution for today's mechanical engineering problems. Each subject is discussed in detail and supported by numerous figures and tables. Now in its eleventh edition, DeGarmo's *Materials and Processes in Manufacturing* has been a market-leading text on manufacturing and manufacturing processes courses for more than fifty years. Authors J. T. Black and Ron Kohser have continued this book's long and distinguished tradition of exceedingly clear presentation and highly practical approach to materials and processes, presenting mathematical models and analytical equations only when they enhance the basic understanding of the material. Completely revised and updated to reflect all current practices, standards, and materials, the eleventh edition has new coverage of additive manufacturing, lean engineering, and processes related to ceramics, polymers, and plastics. An indispensable resource for anyone wanting to create, maintain, improve, understand, or use the diverse information resources within a sci-tech library. \* Over 80 screenshots of electronic information resource tools designed for the engineer and scientist; page reproductions from print sources and illustrations from scholarly journal articles and monographs are also included \* Each chapter concludes with a comprehensive list of additional resources for further research \* Approximately 30 discipline-specific subject bibliographies in the appendix section act as indispensable guides for developing library collections, as well as for compiling introductory textbooks appropriate for library science students \* Included pathfinders provide expert guides for targeted online research \* Corresponding instructor exercises are available at the publisher's website. *Fatigue of Structures and Materials* covers a wide scope of different topics. The purpose of the present book is to explain these topics, to indicate how they can be analyzed, and how this can contribute to the designing of fatigue resistant structures and to

prevent structural fatigue problems in service. Chapter 1 gives a general survey of the topic with brief comments on the significance of the aspects involved. This serves as a kind of a program for the following chapters. The central issues in this book are predictions of fatigue properties and designing against fatigue. These objectives cannot be realized without a physical and mechanical understanding of all relevant conditions. In Chapter 2 the book starts with basic concepts of what happens in the material of a structure under cyclic loads. It illustrates the large number of variables which can affect fatigue properties and it provides the essential background knowledge for subsequent chapters. Different subjects are presented in the following main parts: • Basic chapters on fatigue properties and predictions (Chapters 2-8) • Load spectra and fatigue under variable-amplitude loading (Chapters 9-11) • Fatigue tests and scatter (Chapters 12 and 13) • Special fatigue conditions (Chapters 14-17) • Fatigue of joints and structures (Chapters 18-20) • Fiber-metal laminates (Chapter 21) Each chapter presents a discussion of a specific subject. This book serves as a comprehensive resource on various traditional, advanced and futuristic material technologies for aerospace applications encompassing nearly 20 major areas. Each of the chapters addresses scientific principles behind processing and production, production details, equipment and facilities for industrial production, and finally aerospace application areas of these material technologies. The chapters are authored by pioneers of industrial aerospace material technologies. This book has a well-planned layout in 4 parts. The first part deals with primary metal and material processing, including nano manufacturing. The second part deals with materials characterization and testing methodologies and technologies. The third part addresses structural design. Finally, several advanced material technologies are covered in the fourth part. Some key advanced topics such as "Structural Design by ASIP", "Damage Mechanics-Based Life Prediction and Extension" and "Principles of Structural Health Monitoring" are dealt with at equal length as the traditional aerospace materials technology topics. This book will be useful to students, researchers and professionals

working in the domain of aerospace materials. Gas turbines are widely used in industry for power generation and as a power source at "hard to reach" locations where other possibilities for electrical supply are insufficient. There is a strong need for greener energy, considering the effect that pollution has had on global warming, and we need to come up with ways of producing cleaner electricity. A way to achieve this is by increasing the combustion temperature in gas turbines. This increases the demand on the high temperature performance of the materials used e.g. superalloys in the turbine. These high combustion temperatures can lead to detrimental degradation of critical components. These components are commonly subjected to cyclic loading of different types e.g. combined with dwell-times and overloads at elevated temperatures, which influence the crack growth. Dwell-times have shown to accelerate crack growth and change the cracking behaviour in both Inconel 718 and Haynes 282. Overloads at the beginning of the dwell-time cycle have shown to retard the dwell time effect on crack growth in Inconel 718. To understand these effects more microstructural investigations are needed. The work presented in this licentiate thesis was conducted under the umbrella of the research program Turbo Power; "High temperature fatigue crack propagation in nickel-based superalloys", concentrating on fatigue crack growth mechanisms in superalloys during dwell-times, which have shown to have a devastating effect on the crack propagation behaviour. Mechanical testing was performed under operation-like conditions in order to achieve representative microstructures and material data for the subsequent microstructural work. The microstructures were microscopically investigated in a scanning electron microscope (SEM) using electron channeling contrast imaging (ECCI) as well as using light optical microscopy. The outcome of this work has shown that there is a significant increase in crack growth rate when dwell-times are introduced at the maximum load (0% overload) in the fatigue cycle. With the introduction of a dwell-time there is also a shift from transgranular to intergranular crack growth for both Inconel 718 and Haynes 282. When an overload is applied prior to the dwell-time, the crack growth rate

decreases with increasing overload levels in Inconel 718. At high temperature crack growth in Inconel 718 took place as intergranular crack growth along grain boundaries due to oxidation and the creation of nanometric voids. Another observed growth mechanism was crack advance along phase boundaries with subsequent severe oxidation of the phase. This thesis comprises two parts. The first giving an introduction to the field of superalloys and the acting microstructural mechanisms that influence fatigue during dwell times. The second part consists of two appended papers, which report the work completed so far in the project. An innovative resource for materials properties, their evaluation, and industrial applications The Handbook of Materials Selection provides information and insight that can be employed in any discipline or industry to exploit the full range of materials in use today-metals, plastics, ceramics, and composites. This comprehensive organization of the materials selection process includes analytical approaches to materials selection and extensive information about materials available in the marketplace, sources of properties data, procurement and data management, properties testing procedures and equipment, analysis of failure modes, manufacturing processes and assembly techniques, and applications. Throughout the handbook, an international roster of contributors with a broad range of experience conveys practical knowledge about materials and illustrates in detail how they are used in a wide variety of industries. With more than 100 photographs of equipment and applications, as well as hundreds of graphs, charts, and tables, the Handbook of Materials Selection is a valuable reference for practicing engineers and designers, procurement and data managers, as well as teachers and students. Creep-resistant steels are widely used in the petroleum, chemical and power generation industries. Creep-resistant steels must be reliable over very long periods of time at high temperatures and in severe environments. Understanding and improving long-term creep strength is essential for safe operation of plant and equipment. This book provides an authoritative summary of key research in this important area. The first part of the book describes the specifications and manufacture of



creep-resistant steels. Part two covers the behaviour of creep-resistant steels and methods for strengthening them. The final group of chapters analyses applications in such areas as turbines and nuclear reactors. With its distinguished editors and international team of contributors, Creep-resistant steels is a valuable reference for the power generation, petrochemical and other industries which use high strength steels at elevated temperatures. Describes the specifications and manufacture of creep-resistant steels Strengthening methods are discussed in detail Different applications are analysed including turbines and nuclear reactors Springer Handbook of Condensed Matter and Materials Data provides a concise compilation of data and functional relationships from the fields of solid-state physics and materials in this 1200 page volume. The data, encapsulated in 914 tables and 1025 illustrations, have been selected and extracted primarily from the extensive high-quality data collection Landolt-Börnstein and also from other systematic data sources and recent publications of physical and technical property data. Many chapters are authored by Landolt-Börnstein editors, including the prominent Springer Handbook editors, W. Martienssen and H. Warlimont themselves. The Handbook is designed to be useful as a desktop reference for fast and easy retrieval of essential and reliable data in the lab or office. References to more extensive data sources are also provided in the book and by interlinking to the relevant sources on the enclosed CD-ROM. Physicists, chemists and engineers engaged in fields of solid-state sciences and materials technologies in research, development and application will appreciate the ready access to the key information coherently organized within this wide-ranging Handbook. From the reviews: "...this is the most complete compilation I have ever seen... When I received the book, I immediately searched for data I never found elsewhere..., and I found them rapidly... No doubt that this book will soon be in every library and on the desk of most solid state scientists and engineers. It will never be at rest." -Physicalia Magazine The only source that focuses exclusively on engineering and technology, this important guide maps the dynamic and changing field of information sources published for

engineers in recent years. Lord highlights basic perspectives, access tools, and English-language resources--directories, encyclopedias, yearbooks, dictionaries, databases, indexes, libraries, buyer's guides, Internet resources, and more. Substantial emphasis is placed on digital resources. The author also discusses how engineers and scientists use information, the culture and generation of scientific information, different types of engineering information, and the tools and resources you need to locate and access that material. Other sections describe regulations, standards and specifications, government resources, professional and trade associations, and education and career resources. Engineers, scientists, librarians, and other information professionals working with engineering and technology information will welcome this research This book covers virtually all technical aspects related to the selection, processing, use, and analysis of superalloys. The text of this new second edition has been completely revised and expanded with many new figures and tables added. In developing this new edition, the focus has been on providing comprehensive and practical coverage of superalloys technology. Some highlights include the most complete and up-to-date presentation available on alloy melting. Coverage of alloy selection provides many tips and guidelines that the reader can use in identifying an appropriate alloy for a specific application. The relation of properties and microstructure is covered in more detail than in previous books. The proceedings of the First International Conference on Heat-Resistant Materials, held at Lake Geneva, Wisconsin, September 1991, comprise 75 papers by researchers, designers, manufacturers, fabricators, and end-users, in sessions devoted to materials processing and fabrication, environment effects Materials covered include carbon, alloy and stainless steels; alloy cast irons; high-alloy cast steels; superalloys; titanium and titanium alloys; refractory metals and alloys; nickel-chromium and nickel-thoria alloys; structural intermetallics; structural ceramics, cermets, and cemented carbides; and carbon-composites. Full coverage of materials and mechanical design inengineering Mechanical Engineers' Handbook, Fourth Edition provides a quick guide to

specialized areas you may encounter in your work, giving you access to the basics of each and pointing you toward trusted resources for further reading, if needed. The accessible information inside offers discussions, examples, and analyses of the topics covered. This first volume covers materials and mechanical design, giving you accessible and in-depth access to the most common topics you'll encounter in the discipline: carbon and alloy steels, stainless steels, aluminum alloys, copper and copper alloys, titanium alloys for design, nickel and its alloys, magnesium and its alloys, superalloys for design, composite materials, smart materials, electronic

materials, viscosity measurement, and much more. Presents comprehensive coverage of materials and mechanical design. Offers the option of being purchased as a four-book set or as single books, depending on your needs. Comes in a subscription format through the Wiley Online Library and in electronic and custom formats. Engineers at all levels of industry, government, or private consulting practice will find *Mechanical Engineers' Handbook, Volume 1* a great resource they'll turn to repeatedly as a reference on the basics of materials and mechanical design.

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