Asm Speciality Handbook Heat Resistant Materials Asm

A current and comprehensive treatment of tribology theory andapplications A solid understanding of tribology is essential for engineers inmany fields working to design and ensure the reliability of machineparts and systems. Principles and Applications of Tribology is thefirst truly broad-based book on this vital subject. Moving frombasic theory to practice, it examines tribology from the integratedviewpoint of mechanical engineering, mechanics, and materialsscience. It offers detailed coverage of the mechanisms of materialwear, friction, and all of the major lubrication techniques--liquids, solids, and gases-- and examines a wide range of bothtraditional and state-of-the-art applications. Based on the author's extensive research and teaching experience inthe areas of tribology, mechanics, and materials science for morethan thirty years, this book emphasizes a contemporary knowledge oftribology that includes the emerging field of micro/nanotribologyand various industrial applications, including cutting-edge topicssuch as magnetic information storage devices andmicroelectromechanical systems. Principles and Applications of Tribology is invaluable formechanical, chemical, and materials engineers involved in productand process design, as well as graduate students and researchers inthese areas.

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 provided the most detailed information on the most industrially important materials.

CD-ROM contains: the mechanical design software MDESIGN, which "enables users to quickly complete the design of many of the machine elements discussed in the book."

This ASM Handbook is the most comprehensive collection of engineering information on this important structural material published in the last sixty years. Prepared with the cooperation of the International Magnesium Association, it presents the current industrial practices and provides information and data about the properties and performance of magnesium alloys. Materials science and engineering are covered, including processing, properties, and commercial uses.

Full coverage of electronics, MEMS, and instrumentation and control in mechanical engineering This second volume of Mechanical Engineers' Handbook covers electronics, MEMS, and instrumentation and control, giving you accessible and in-depth access to the topics you'll encounter in the discipline: computer-aided design, product design for manufacturing and assembly, design optimization, total quality management in mechanical system design, reliability in the mechanical design process for sustainability, life-cycle design, design for remanufacturing processes, signal processing, data acquisition and display systems, and much more. The book 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, rather than the straight data, formulas, and calculations you'll find in other handbooks. Presents the most comprehensive coverage of the entire discipline of

Mechanical Engineering anywhere in four interrelated books Offers the option of being purchased as a four-book set or as single books Comes in a subscription format through the Wiley Online Library and in electronic and custom formats Engineers at all levels will find Mechanical Engineers' Handbook, Volume 2 an excellent resource they can turn to for the basics of electronics, MEMS, and instrumentation and control.

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.

Proceedings of the IUTAM Symposium held in Abisko National Park, Kiruna, Sweden, July 31-August 4, 2000

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.

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.

Stainless steel is still one of the fastest growing materials. Today, the austenitic stainless steel with the classic composition of 18% Cr and 8% Ni (grade 304L) is still the most widely used by far in the world. The unique characteristic of stainless steel arises from three main factors. The versatility results from high corrosion resistance, excellent low- and high-temperature properties, high toughness, formability, and weldability. The long life of stainless steels has been proven in service in a wide range of environments, together with low maintenance costs compared to other highly alloyed metallic materials. The retained value of stainless steel results from the high intrinsic value and easy recycling. Stainless steel, especially of austenitic microstructure, plays a crucial role in achieving sustainable development nowadays, so it is also important for further generations.

MCrAlY coatings (M=Ni and/or Co) have been widely used for the protection of superalloy components against oxidation and hot corrosion in the hot sections of gas turbines. The drive to improve engine combustion efficiency while reducing emissions by increasing the operation temperature brings a big challenge for coating design. As a result, the need for improvement of MCrAlY coatings for better oxidation resistance is essential. Formation of a stable, dense, continuous, and slow-growing ?-Al2O3 layer, on

the MCrAlY coating surface, is the key to oxidation protection, since the protective ?-Al2O3 scale offers superior oxidation resistance due to its lower oxygen-diffusion rate as compared with other oxides. The ability of a MCrAlY coating to form and maintain such a protective scale depends on the coating composition and microstructure, and can be improved through optimization of deposition parameters, modification of coating surface conditions, and so on. Part of this thesis work focuses on studying the effect of post-deposition surface treatments on the oxidation behavior of MCrAlX coatings (X can be yttrium and/or other minor alloying elements). The aim is to gain fundamental understanding of alumina scale evolution during oxidation which is important for achieving improved oxidation resistance of MCrAlX coatings. Oxide scale formed on coatings at initial oxidation stage and the effect of surface treatment were investigated by a multi-approach study combining photo-stimulated luminescence, microstructural observation and weight gain. Results showed that both mechanically polished and shot-peened coatings exhibited superior performance due to rapid formation of ?-Al2O3 fully covering the coating and suppressing growth of transient alumina, assisted by the high density of ?-Al2O3 nuclei on surface treatment induced defects. The early development of a two-layer alumina scale, consisting of an inward-grown inner ?-Al2O3 layer and an outer layer transformed from outward-grown transient alumina, resulted in a higher oxide growth rate of the as-sprayed coating. The positive effect of the surface treatments on retarding oxide scale growth and suppressing formation of spinel was also observed in oxidation test up to 1000 hrs. As the oxidation proceeds to the close-to-end stage, a reliable criterion to estimate the capability of coating to form ?-Al2O3 is of great importance to accurately evaluate coating lifetime, which is the aim of the other part of the thesis work. Survey of published results on a number of binary Ni-Al and ternary Ni-Cr-Al, Ni-Al-Si systems shows that the empirical Al-concentration based criterion is inadequate to properly predict the formation of a continuous ?-Al2O3 scale. On the other hand, correlating the corresponding Al-activity data, calculated from measured chemical compositions using the Thermo-Calc software, to the experimental oxidation results has revealed a temperature dependent, critical Al-activity value for forming continuous ?-Al2O3 scale. To validate the criterion, long-term oxidation tests were performed on five MCrAlX coatings with varying compositions and the implementation of the Al-activity based criterion on these coatings successfully predicted ?-Al2O3 formation, showing a good agreement with experiment results.

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 power supplies are insufficient. New ways of producing greener energy is needed to reduce emission levels. This can be achieved by increasing the combustion temperature of gas turbines. High combustion temperatures can be detrimental and degrade critical components. This raises the demands on the high temperature performance of the superalloys used in gas turbine components. These components are frequently subjected to different cyclic loads combined with for example dwell-times and overloads at elevated temperatures, which can influence the crack growth. Dwell-times have been shown to accelerate crack growth and change cracking behaviour in both Inconel 718, Haynes 282 and Hastelloy X. On the other hand, overloads at the beginning of a dwell-time cycle have been shown to retard the dwell-time effect on crack growth in Inconel 718. More experiments and microstructural investigations are needed to better understand these effects. The work presented in this

thesis was conducted under the umbrella of the research program Turbo Power; "High temperature fatigue crack propagation in nickel-based superalloys", where I have mainly looked at fatigue crack growth mechanisms in superalloys subjected to dwell-fatigue, which can have a devastating effect on crack propagation behaviour. Mechanical testing was performed under operation-like cycles in order to achieve representative microstructures and material data for the subsequent microstructural work. Microstructures were investigated using light optical microscopy and scanning electron microscopy (SEM) techniques such as electron channeling contrast imaging (ECCI) and electron backscatter diffraction (EBSD). The outcome of this work has shown that there is a significant increase in crack growth rate when dwell-times are introduced at 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. The crack growth rate decreases with increasing overload levels in Inconel 718 when an overload is applied prior to the dwell-time. At high temperature, intergranular crack growth was observed in Inconel 718 as a result of oxidation and the creation of nanometric voids. Another observed growth mechanism was crack advance along ?-phase boundaries with subsequent oxidation of the ?-phase. This thesis comprises two parts. Part I gives an introduction to the field of superalloys and the acting microstructural mechanisms related to fatigue and crack propagation. Part II consists of five appended papers, which report the work completed as part of the project.

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

Additive manufacturing (AM) is one of the manufacturing processes that warrants the attention of industrialists, researchers, and scientists. AM has the ability to fabricate materials to produce parts with complex shapes without any theoretical restrictions combined with added functionalities. Selective laser melting (SLM), also known as laser-based powder bed processing (LPBF), is one of the main AM process that can be used to fabricate wide variety of materials that are Al-, Ti-, Fe-, Ni-, Co-, W-, Ag-, and Au-based, etc. However, several challenges need to be addressed systematically, such as development of new materials that suit the SLM process conditions so the process capabilities can be fully used to produce new properties in these materials. Other issues in

the field are the lack of microstructure–property correlations, premature failure, etc. Accordingly, this Special Issue (book) focuses mainly on the microstructure-correlation in three different alloys: AlSi10Mg, Ti6Al4V, and 304L stainless steel, where six articles are presented. Hence, this Special Issue outlines microstructure–property correlations in the SLM processed materials and provides a value addition to the field of AM.

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 signi?cance 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 speci?c subject.

MCrAlY coatings (M=Ni and/or Co) are widely used for the protection of superalloy components against oxidation and hot corrosion in the hot sections of gas turbines. The drive for coating systems to bestow adequate oxidation and corrosion resistance upon the components becomes urgent as an inevitable result of the necessary improvement in engine combustion efficiency and service lifetime. Through the careful design of the composition, MCrAlY coating performance can be optimized to meet the needs under different service conditions and component materials, therefore, “MCrAlX”, with “X” stands for the minor alloying elements, is used to highlight the effect. In the present thesis, the performance of new MCrAlX coatings is investigated with respect to oxidation, hot corrosion and interactions between coating-superalloy substrates. Oxidation of MCrAlX coatings can be generally categorized into initial, steady and close-to-end stages. Coating performance can be affected by various factors at different stages, therefore, experiments were designed by targeting the oxidation stages. Investigation on the initial stage oxidation behavior of MCrAlY coatings with post-deposition surface treatments reveals the different growth mechanisms of alumina scales. Surface treatments significantly reduce the alumina growth rate by suppressing transient alumina development and aiding the early formation of ?-Al2O3, which improves the long-term oxidation performance of the coating. Similarly, the modification of minor alloy elements in MCrAlX coatings also serves the purpose. The oxidation behavior of new MCrAlX coatings was investigated at the steady oxidation stage, followed by the microstructure observation, thermodynamic and kinetic simulations. As an alternative reactive element addition of Y, Ce shows a negative effect on the formation of columnar alumina scales of high strain tolerance. In

comparison, Fe or Ru addition shows no influence on alumina growth, rather than strengthening the phase stability in the coating and reducing the interdiffusion between coating-substrate through different mechanisms. As the oxidation proceeds to the close-to-end stage, a reliable criterion to estimate the capability of coating to form ?-Al2O3 is of great importance to accurately evaluate coating lifetime. A temperature-dependent critical Al-activity criterion was proposed to better predict the formation of a continuous ?-Al2O3 scale based on correction of elemental activity using thermodynamic database to replace the empirical Al-concentration based criterion. Severe interdiffusion occurs between coating-substrate during high temperature oxidation, accelerating the degradation of the system. Interdiffusion behavior of diffusion couples of superalloys-MCrAlX coatings were examined. It is highlighted that the recrystallization of superficial layer of the substrate contributes to the secondary reaction zone formation and element interdiffusion controls subsequent zone thickening. Study on Type I hot corrosion behavior of new MCrAlX coatings shows that the addition of Fe has no influence on basic fluxing reactions before severe Al depletion from the coating occurs. Instead, it boosts the “effective” Al supply of coating by shifting the equilibrium concentration of Al in the ? phase to a low Al level. Besides, the pre-mature coating degradation at the coating-substrate interface was due to the fast growth of corrosion products from substrate induced large local volume expansions, resulting in early coating spallation. MCrAlY ytbeläggningar (M=Ni och/eller Co) används ofta för att skydda komponenter tillverkade av superlegeringar mot oxidation samt högtemperaturskorrosion i de heta gasturbindelarna. Förbättrad förbränningseffektivitet och livslängd hos gasturbiner, gör att ytbeläggningssystemen måste besitta adekvata oxidations- och korrosionsmotstånd. Genom att omsorgsfullt utforma den kemiska sammansättningen hos MCrAlY ytbeläggningar kan deras prestanda optimeras för att möta kraven från olika driftförhållanden samt olika substratmaterial, därför används beteckningen "MCrAlX" för att belysa förändringar av den kemiska kompositionen, där "X" står för reaktiva legeringsämnen som tillsätts i mindre mängder. I denna avhandling undersöks prestandan hos en ny MCrAlX ytbeläggning med hänsyn till oxidation, högtemperaturskorrosion och interaktionen mellan ytbeläggningen och superlegeringssubstratet. Oxidation av MCrAlX ytbeläggningar kan generellt kategoriseras i tre faser; initiala, stabila och nära-slutet fasen. Ytbeläggningens prestanda kan påverkas av olika faktorer vid de olika faserna, därför utformades olika experiment för att undersöka de olika oxidationsfaserna. Undersökningen av den initiala fasen av oxidationsbeteendet hos MCrAlX ytbeläggningar som genomgått ytbehandlingar efter ytbeläggningsdeponeringen avslöjade olika tillväxtmekanismer hos aluminiumoxidskikten. Aluminiumoxidens tillväxthastighet reducerades signifikant av ytbehandlingarna, detta genom att undertrycka utvecklingen av övergående aluminiumoxid och bistå den tidiga tillväxten av ?-Al2O3, vilket förbättrar ytbeläggningens oxidationsprestanda långsiktigt. De reaktiva legeringsämnena som tillsätts i mindre mänger påverkar ytbeläggningens oxidationsprestanda på liknande sätt. Oxidationsbeteendet hos de nya MCrAlX ytbeläggningarna i den stabila fasen följdes av mikrostrukturundersökning, termodynamiska och kinetiska simuleringar. Det framkom att Ce visar en negativ effekt på bildandet av kolumnära aluminiumoxidskikt med hög töjningstolerans som alternativt reaktivt legeringsämne till Y. Jämförelsevis ger Fe- eller Ru-tillsatser ingen påverkan på aluminiumoxidtillväxten, förutom att det förstärker fasstabiliteten i ytbeläggningen samt genom olika

mekanismer reducerar interdiffusionen mellan ytbeläggningen och substratet. När oxidationsprocessen kommit till nära-slutet fasen, är det viktigt att uppskatta kapaciteten hos en ytbeläggning att bilda ?-Al2O3, detta då det är ett tillförlitligt kriterium för att noggrant kunna utvärdera ytbeläggningens livslängd. Därför föreslogs ett temperaturberoende kriterium för kritisk Al-aktivitet för att bättre kunna förutsäga bildandet av ett kontinuerligt ?-Al2O3-skikt. Kriteriet baserades på korrigering av legeringsämnens aktivitet genom att använda en termodynamisk databas, detta för att ersätta det empiriska Al-koncentrations baserade kriteriet. Vid högtemperatursoxidation sker en omfattande interdiffusion mellan ytbeläggningen och substratet, vilket accelererar degraderingen av ytbeläggningssystemet. Därför har interdiffusionsbeteendet mellan superlegeringssubstratet och MCrAlX ytbeläggningen undersökts i denna avhandling. Det framkom att rekristallisationen av ytliga skikt av substratet bidrar till formationen av den sekundära reaktionszonen och att interdiffusion kontrollerar zonens efterföljande tjocklektillväxt. Undersökningen av Typ I högtemperaturskorrosionsbeteendet hos en ny MCrAlX ytbeläggning visar att legeringstillägg av Fe inte påverkar de grundläggande flödesreaktionerna innan en kritisk Al utarmning sker i ytbeläggningen. Istället stimulerar det tillförseln av Al genom att skifta jämviktskoncentrationen av Al i ? fasen till en låg nivå av Al. Det framkom också att den tidiga degraderingen av ytbeläggningen vid gränsskiktet mellan ytbeläggningen och substratet kommer av att den snabba tillväxten av korrosionsprodukter från substratet inducerade en stor lokal volymsutvidgning, vilket ledde till tidig ytbeläggningsspallation.

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.

The Light Metals symposia are a key part of the TMS Annual Meeting & Exhibition, presenting the most recent developments, discoveries, and practices in primary aluminum science and technology. Publishing the proceedings from these important symposia, the Light Metals volume has become the definitive reference in the field of aluminum production and related light metal technologies. The 2015 collection includes papers from the following symposia: 1.Alumina and Bauxite 2.Aluminum Alloys: Fabrication, Characterization and Applications 3.Aluminum Processing 4.Aluminum Reduction Technology 5.Cast Shop for Aluminum Production 6.Electrode Technology for Aluminum Production 7.Strip Casting of Light Metals

The Journal of Manufacturing and Materials Processing (JMMP) aims to provide an international forum for the documentation and dissemination of recent, original, and significant research studies in the analysis of processes, equipment, systems, and materials related to material heat treatment, solidification, deformation, addition, removal, welding, and accretion for the industrial fabrication and production of

parts, components, and products. The JMMP was established in 2017 and has published more than 300 contributions. It has been listed in the ESCI, Inspec (IET), and Scopus (Elsevier). In celebration of the anniversary of the JMMP, the Editorial Office has put together this Special Issue, which includes several representative papers that reflect the vibrant growth and dynamic trend of research in this field.

This book is a comprehensive compilation of chapters on materials (both established and evolving) and material technologies that are important for aerospace systems. It considers aerospace materials in three Parts. Part I covers Metallic Materials (Mg, Al, Al-Li, Ti, aero steels, Ni, intermetallics, bronzes and Nb alloys); Part II deals with Composites (GLARE, PMCs, CMCs and Carbon based CMCs); and Part III considers Special Materials. This compilation has ensured that no important aerospace material system is ignored. Emphasis is laid in each chapter on the underlying scientific principles as well as basic and fundamental mechanisms leading to processing, characterization, property evaluation and applications. This book will be useful to students, researchers and professionals working in the domain of aerospace materials.

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.

ASM Specialty HandbookHeat-Resistant MaterialsASM International

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

Cast iron offers the design engineer a low-cost, high-strength material that can be easily cast into a wide variety of useful, and sometimes complex, shapes. This handbook from ASM covers the entire spectrum of one of the most widely used and versatile of all metals.

High-temperature corrosion is a major problem affecting sectors such as the power generation, aerospace and metal-working industries. This important book summarises a wide range of research on ways of dealing with this important problem. The first part of the book reviews ways of modifying alloys to improve high-temperature corrosion resistance. The second part discusses surface treatments such as pre-treatments and coatings. The third part of the book summarises research on testing for high-temperature corrosion resistance and the development of common testing standards. It also reviews research on the behaviour of alloys in a wide range of service conditions such as furnace and boiler environments. The final part of the book discusses ways of modelling high-temperature corrosion processes to improve material performance and service life. With its distinguished editors and team of contributors drawn from some of the leading centres of research in the field, Novel approaches to improving high-temperature

corrosion resistance is a standard reference for all those studying and dealing with high-temperature corrosion. Summarises a wide range of research on ways of dealing with high-temperature corrosion Discusses ways of modelling high-temperature corrosion processes to improve material performance and service life A standard reference for all those studying and dealing with high-temperature corrosion

This reference documents ferrous alloy development as presented in Alloy Digest since 1952. Its concise data sheet summaries (which run about two pages) provide material composition, properties, heat treatment, fabrication characteristics, product forms, and applications. Following a general overvie

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 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.

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.

One of the first books new engineers and technicians should read. This new edition of the perennial best seller preserves the core of the previous editions, focusing on the metallurgical and materials evaluation for failure mode identification. Comprehensive information covering the basic principles and practices are clearly explained.

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.

The era of lean production and excellence in manufacturing, advancing with sustainable development, demands the rational utilization of raw materials and energy resources, adopting cleaner and environmentally-friendly industrial processes. In view of the new industrial revolution, through digital transformation, the exploitation of smart and sophisticated materials systems, the need of minimizing scrap and increasing efficiency, reliability and lifetime and, on the other hand, the pursuit of fuel economy and limitation of carbon footprint, are necessary conditions for the imminent growth in a highly competitive economy. Failure analysis is an

interdisciplinary scientific topic, reflecting the opinions and interpretations coming from a systematic evidence-gathering procedure, embracing various important sectors, imparting knowledge, and substantiating improvement practices. The deep understanding of material/component role (e.g., rotating shaft, extrusion die, gas pipeline) and properties will be of central importance for fitness for purpose in certain industrial processes and applications. Finally, it is hoped and strongly believed that the accumulation of additional knowledge in the field of failure mechanisms and the adoption of the principles, philosophy, and deep understanding of failure analysis process approach will strongly promote the learning concept, as a continuously evolving process leading to personal and social progress and prosperity.

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.

This handbook surveys the range of methods and fuel types used in generating energy for industry, transportation, and heating and cooling of buildings. Solar, wind, biomass, nuclear, geothermal, ocean and fossil fuels are discussed and compared, and the thermodynamics of energy conversion is explained. Appendices are provided with fully updated data. Thoroughly revised, this second edition surveys the latest advances in energy conversion from a wide variety of currently available energy sources. It describes energy sources such as fossil fuels, biomass (including refuse-derived biomass fuels), nuclear, solar radiation, wind, geothermal, and ocean, then provides the terminology and units used for each energy resource and their equivalence. It includes an overview of the steam power cycles, gas turbines, internal combustion engines, hydraulic turbines, Stirling engines, advanced fossil fuel power systems, and combined-cycle power plants. It outlines the development, current use, and future of nuclear power.

If you are involved with machining or metalworking or you specify materials for industrial components, this book is an absolute must. It gives you detailed and comprehensive information about the selection, processing, and properties of materials for machining and metalworking applications. They include wrought and powder metallurgy tool steels, cobalt base alloys, cemented carbides, cermets, ceramics, and ultra-hard materials. You'll find specific guidelines for optimizing machining productivity through the proper selection of cutting tool materials plus expanded coverage on the use of coatings to extend cutting tool and die life. There is also valuable information on alternative heat treatments for improving the toughness of tool and die steels. All new material on the correlation of heat treatment microstructures and properties of tool steels is supplemented with dozens of photomicrographs. Information on special tooling considerations for demanding applications such as isothermal forging, die casting of metal matrix composites, and molding of corrosive plastics is also included. And you'll learn about alternatives to ferrous materials for metalworking applications such as carbides, cermets, ceramics, and nonferrous metals like aluminum, nickel, and copper base alloys.

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.

This one-stop reference is a tremendous value and time saver for engineers, designers and researchers. Emerging technologies, including aluminum metal-matrix composites, are combined with all the essential aluminum information from the ASM Handbook series (with updated statistical information).

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

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.