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# Oxide Scale Behavior In High Temperature Metal Processing

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Fundamentals and Engineering

Hot Stamping Advanced Manufacturing Technology of Lightweight Car Body

Introduction to High Temperature Oxidation and Corrosion

Proceedings of Chinese Materials Conference 2017

High Temperature Oxidation and Ignition Behaviour of Magnesium Alloys Containing Strontium (Sr) and Neodymium (Nd)

Intermetallics Research Progress

Thermomechanical Fatigue Behavior of Materials

Joint EPRI - 123HiMAT International Conference on Advances in High-Temperature Materials

Non-Destructive Evaluation of Corrosion and Corrosion-assisted Cracking

Structural Intermetallics and Intermetallic Matrix Composites

second volume

Advances in Materials Technology for Fossil Power Plants

High Temperature Corrosion

The Effect of Surface-applied Reactive Elements on the High Temperature Oxidation of Chromium-containing Alloys

High Temperature Corrosion of Advanced Materials and Protective Coatings

High Temperature Corrosion

Self-Organization During Friction

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Waste Production and Utilization in the Metal Extraction Industry

Long-Term Cyclic Oxidation Behavior of Wrought Commercial Alloys at High Temperatures

Springer Handbook of Metrology and Testing

Proceedings of the Per Kofstad Memorial Symposium

Proceedings of the International Symposium

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High Performance Structural Materials

Wear of Materials

High Temperature Oxidation Behavior of Gamma-Ni+gamma'-Ni<sub>3</sub>Al Alloys and Coatings Modified with Pt and Reactive Elements

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Proceedings from the Fourth International Conference, October 25-28, 2004, Hilton Head Island, South Carolina

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## MATHIAS RICE

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### **Fundamentals and Engineering** CRC Press

Refractory metals such as W, Mo, Ta, Nb, and Re have immense potential for application in plasma-facing materials in nuclear reactors, defense materials, aviation counterweights, heating elements in furnaces, and so forth. This book presents a wide perspective of oxide dispersion strengthened refractory alloys fabrication and critical properties. It provides a comprehensive road map for an appropriate basis for alloy design, process parameter selection, fabrication route, and deformation behavior for oxide dispersion strengthened refractory alloys. It further covers achievement of application-oriented properties and critical process-regulating parameters for development of sustainable materials. Features: Covers development of oxide dispersion strengthened sustainable material to withstand high-temperature environments Describes stimulating application-oriented final mechanical properties Illustrates fabrication of alloys through effective route to achieve desired properties Presents in-depth explanation of deformation behavior at ambient and high temperatures Explores critical applications of the alloys in nuclear reactors, defense, and aviation sectors Oxide Dispersion Strengthened Refractory Alloys will be of interest to graduate students and researchers in high-temperature materials, mechanics, metallurgy, powder metallurgy, and physical metallurgy. *Hot Stamping Advanced Manufacturing Technology of Lightweight Car Body* Trans Tech Publications Ltd

A comprehensive text to the non-destructive evaluation of degradation of materials due to environment that takes an interdisciplinary approach Non-Destructive Evaluation of Corrosion and Corrosion-assisted Cracking is an important resource that covers the critical interdisciplinary topic of non-destructive evaluation of degradation of materials due to environment. The authors—noted experts in the field—offer an overview of the wide-variety of approaches to non-destructive evaluation and various types of corrosion. The text is filled with instructive case studies from a range of industries including aerospace, energy, defense, and processing. The authors review the most common non-destructive evaluation techniques that are applied in both research and industry in order to evaluate the properties and more importantly degradation of materials components or systems without causing damage. Ultrasonic, radiographic, thermographic, electromagnetic, and optical are some of the methods explored in the book. This important text: Offers a groundbreaking interdisciplinary approach to of non-destructive evaluation of corrosion and corrosion-assisted cracking Discusses techniques for non-destructive evaluation and various types of corrosion Includes information on the application of a variety of techniques as well as specific case studies Contains information targeting industries such as aerospace, energy, processing Presents information from leading researchers and technologists in both non-destructive evaluation and corrosion Written for life assessment and maintenance personnel involved in quality control, failure analysis, and R&D, Non-Destructive Evaluation of Corrosion and Corrosion-assisted Cracking is an essential interdisciplinary guide to the topic.

### Introduction to High Temperature Oxidation and Corrosion CRC Press

Oxide Scale Behavior in High Temperature Metal Processing John Wiley & Sons

*Proceedings of Chinese Materials Conference 2017* Elsevier

High Temperature Coatings, Second Edition, demonstrates how to counteract the thermal effects of rapid corrosion and degradation of exposed materials and equipment that can occur under high operating temperatures. This is the first true practical guide on the use of thermally protective coatings for high-temperature applications, including the latest developments in materials used for protective coatings. It covers the make-up and behavior of such materials under thermal stress and the methods used for applying them to specific types of substrates, as well as invaluable advice on inspection and repair of existing thermal coatings. With his long experience in the aerospace gas turbine industry, the author has compiled the very latest in coating materials and coating technologies, as well as hard-to-find guidance on maintaining and repairing thermal coatings, including appropriate inspection protocols. The book is supplemented with the latest reference information and additional support to help readers find more application- and industry-type coatings specifications and uses. Offers an overview of the underlying fundamental concepts of thermally-protective coatings, including thermodynamics, energy kinetics, crystallography and equilibrium phases Covers essential chemistry and physics of underlying substrates, including steels, nickel-iron alloys, nickel-cobalt alloys and titanium alloys Provides detailed guidance on a wide variety of coating types, including those used against high temperature corrosion and oxidative degradation and thermal barrier coatings

*High Temperature Oxidation and Ignition Behaviour of Magnesium Alloys Containing Strontium (Sr) and Neodymium (Nd)* ASM International

Volume is indexed by Thomson Reuters CPCI-S (WoS). This volume contains 80 selected peer-reviewed papers, divided into the sections: Fundamentals of High-Temperature Oxidation and Corrosion, Steam Oxidation and Influence of Hydrogen, Protective Coatings and Surface Treatments, Mechanical and Chemical Aspects of Scale Adhesion, Corrosion in Incinerators and Metal Dusting and Oxidation of Ceramics and Intermetallics.

*Intermetallics Research Progress* John Wiley & Sons

Selected, peer reviewed papers from the 3rd International Symposium on High-Temperature Oxidation and Corrosion, (ISHOC), November 8-11, 2010, Zushi, Japan

*Thermomechanical Fatigue Behavior of Materials* Elsevier

The result of a fruitful, on-going collaboration between academia and industry, this book reviews recent advances in research on oxide scale behavior in high-temperature forming processes. Presenting novel, previously neglected approaches, the authors emphasize the pivotal role of reproducible experiments to elucidate the oxide scale properties and develop quantitative models with predictive accuracy. Each chapter consists of a detailed, systematic examination of different aspects of oxide scale formation with immediate impact for researchers and developers in industry. The clear and stringent style of presentation makes this monograph both coherent and easily readable.

**Joint EPRI - 123HiMAT International Conference on Advances in High-Temperature Materials** Elsevier

In our present era of nanoscience and nanotechnology, new materials are poised to take center stage in dramatically improving friction and wear behavior under extreme conditions. Compiled by two eminent experts, *Self-Organization During Friction: Advanced Surface-Engineered Materials and Systems Design* details the latest advances and developments in

*Non-Destructive Evaluation of Corrosion and Corrosion-assisted Cracking* The Electrochemical Society

This book summarizes the advanced manufacturing technology of original innovations in hot stamping of lightweight car body. A detailed description of the technical system and basic knowledge of sheet metal forming is given, which helps readers quickly understand the relevant knowledge in the field. Emphasis has been placed on the independently developed hot stamping process and equipment, which help describe the theoretical and experimental research on key problems involving stress field, thermal field and phase transformation field in hot stamping process. Also, a description of the formability at elevated temperature and the numerical simulation algorithms for high strength steel hot stamping is given in combination with the experiments. Finally, the book presents some application cases of hot stamping technology such as the lightweight car body design using hot stamping components and gradient hardness components, and the cooling design of the stamping tool. This book is intended for researchers, engineers and graduate students in vehicle engineering, mechanical engineering, especially in the field of advanced manufacturing technology. The book also provides a useful reference for other new technology related temperature and phase transformation, such as aluminum-magnesium alloy hot stamping.

**Structural Intermetallics and Intermetallic Matrix Composites** Wiley-American Ceramic Society

Materials for high-pressure turbine blades must be able to operate in the high-temperature gases (above 1000 C) emerging from the combustion chamber. Accordingly, the development of nickel-based superalloys has been constantly motivated by the need to have improved engine efficiency, reliability and service lifetime under the harsh conditions imposed by the turbine environment. However, the melting point of nickel (1455 C) provides a natural ceiling for the temperature capability of nickel-based superalloys. Thus, surface-engineered turbine components with modified diffusion coatings and overlay coatings are used. These coatings are capable of forming a compact and adherent oxide scale, which greatly impedes the further transport of reactants between the high-temperature gases and the underlying metal and thus reducing attack by the atmosphere. Typically, these coatings contain  $\gamma$ -NiAl as a principal constituent phase in order to have sufficient aluminum content to form an Al<sub>2</sub>O<sub>3</sub> scale at elevated temperatures. The drawbacks to the currently used  $\gamma$ -based coatings, such as phase instabilities, associated stresses induced by such phase instabilities, and extensive coating/substrate interdiffusion, are major motivations in this study to seek next-generation coatings. The high-temperature oxidation resistance of novel Pt + Hf-modified  $\gamma$ -Ni +  $\gamma$ -Ni<sub>3</sub>Al-based alloys and coatings were investigated in this study. Both early-stage and 4-days isothermal oxidation behavior of single-phase  $\gamma$ -Ni and  $\gamma$ -Ni<sub>3</sub>Al alloys were assessed by examining

the weight changes, oxide-scale structures, and elemental concentration profiles through the scales and subsurface alloy regions. It was found that Pt promotes Al<sub>2</sub>O<sub>3</sub> formation by suppressing the NiO growth on both  $\gamma$ -Ni and  $\gamma$ -Ni<sub>3</sub>Al single-phase alloys. This effect increases with increasing Pt content. Moreover, Pt exhibits this effect even at lower temperatures (970 C) in the very early stage of oxidation. It was also inferred that Pt enhances the diffusive flux of aluminum from the substrate to the scale/alloy interface. Relatively low levels of hafnium addition to Pt-free  $\gamma$ -Ni<sub>3</sub>Al increased the extent of external NiO formation due to non-protective HfO<sub>2</sub> formation. Accordingly, this effect intensified with increasing Hf content from 0.2 to 0.5 at. %.

**second volume** The Electrochemical Society

This text for graduate and post graduate students covers fundamentals of high temperature corrosion and related topics. Early chapters cover the thermodynamics and kinetics of oxidation and defect structure of oxides and diffusion in oxides, and later chapters cover thin and thick layer oxidation, o

**Advances in Materials Technology for Fossil Power Plants** Elsevier

This book is a printed edition of the Special Issue "Advances in Plastic Forming of Metals" that was published in *Metals*

*High Temperature Corrosion* Springer Science & Business Media

Fills a Prominent Gap in a Significant Area of Intermetallics Presenting a comprehensive overview of structural intermetallics (the most important class of intermetallics), *Structural Intermetallics and Intermetallic Matrix Composites* is a reference written with the beginning student as well as the practicing professional in mind. Utilizing the author's more than two decades of experience working on silicides and teaching a course on advanced materials, this text addresses the fundamental aspects related to structure, mechanical behavior, and the oxidation resistance of selected intermetallics and their composites. In addition to covering the structure and properties of selected intermetallics, the text places special emphasis on composite intermetallics and specifically focuses on select aluminides and silicides. It reviews existing literature on select structural silicides and aluminides, considers possible applications on the basis of the attractive properties of aluminides and silicides, and also factors in future directions of research. Fundamental aspects include thermodynamic principles, phase diagrams and crystal structures, processing methods, deformation and fracture mechanisms of ordered intermetallics, and oxidation behavior with mechanisms for protection against environmental degradation. Comprising nine chapters, this text: Explores the state-of-the-art accomplishments in this area Considers further research related to the topic Examines further innovations applying these materials An up-to-date introduction to structural intermetallics, *Structural Intermetallics and Intermetallic Matrix Composites* helps readers grasp the complexities of the structure of intermetallics and their effect on various physical and mechanical properties. It also highlights the recent state of development in the field.

*The Effect of Surface-applied Reactive Elements on the High Temperature Oxidation of Chromium-containing Alloys* John Wiley & Sons

This book aims to show how tribological concepts can be applied in order to improve manufacturing technology in modern industry. It can be used as a guide book for engineering students or a reference useful for academics in the fields of tribology, manufacturing, materials and mechanical

engineering.

**High Temperature Corrosion of Advanced Materials and Protective Coatings** CRC Press  
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

High Temperature Corrosion Nova Publishers

Intermetallics is concerned with all aspects of ordered chemical compounds between two or more metals and notably with their applications. This book covers new and important research on the crystal chemistry and bonding theory of intermetallics; determination and analysis of phase diagrams; the nature of superlattices, antiphase domains and order-disorder transitions; the geometry and dynamics of dislocations and related defects in intermetallics; theory and experiments relating to flow stress, work-hardening, fatigue and creep; response of deformed intermetallics to annealing; magnetic and electrical properties of intermetallics; structure and properties of grain and interphase boundaries; the effect of deviations from stoichiometry on physical and mechanical properties; crystallisation of intermetallics from the melt or amorphous precursors.

**Self-Organization During Friction** CRC Press

Increasingly stringent environmental regulations and industry adoption of waste minimization guidelines have thus, stimulated the need for the development of recycling and reuse options for metal related waste. This book, therefore, gives an overview of the waste generation, recycle and reuse along the mining, beneficiation, extraction, manufacturing and post-consumer value chain. This book reviews current status and future trends in the recycling and reuse of mineral and metal waste and also details the policy and legislation regarding the waste management, health and environmental impacts in the mining, beneficiation, metal extraction and manufacturing processes. This book is a useful reference for engineers and researchers in industry, policymakers and legislators in governance, and academics on the current status and future trends in the recycling and reuse of mineral and metal waste. Some of the key features of the book are as follows: Holistic approach to waste generation, recycling and reuse along the minerals and metals extraction. Detailed overview of metallurgical waste generation. Practical examples with complete flow sheets, techniques and interventions on waste management. Integrates the technical issues related to efficient resources utilization with the policy and regulatory framework. Novel approach to addressing future commodity shortages.

**Advances and Real-Life Applications** ASTM International

The 14th International Conference on Wear of Materials took place in Washington, DC, USA, 30 March - 3 April 2003. These proceedings contain over two-hundred peer reviewed papers containing the best research, technical developments and engineering case studies from around the world. Biomaterials and nano-tribology receive special attention in this collection reflecting the general trends in the field. Further highlights include a focus on the new generation of instrumentation to probe wear at increasingly small scales. Approximately ninety communications and case studies, a popular format for the academic community have also been included, enabling the inclusion of the

most up-to-date research. Over 200 peer-reviewed papers including hot topics such as biomaterials and nano-tribology Keeping you up-to-date with the latest research from leading experts Includes communications and case studies

Oxide Dispersion Strengthened Refractory Alloys Springer Science & Business Media

The world's ever-growing demand for power has created an urgent need for new efficient and sustainable sources of energy and electricity. Today's consumers of portable electronics also demand devices that not only deliver more power but are also environmentally friendly. Fuel cells are an important alternative energy source, with promise in military, commercial and industrial applications, for example power vehicles and portable devices. A fuel cell is an electrochemical device that directly converts the chemical energy of a fuel into electrical energy. Fuel cells represent the most efficient energy conversion technologies to-date and are an integral part in the new and renewable energy chain (e.g., solar, wind and hydropower). Fuel cells can be classified as either high-temperature or lowtemperature, depending on their operating temperature, and have different materials requirements. This book is dedicated to the study of high temperature fuel cells. In hightemperature fuel cells, the electrolyte materials are ceramic or molten carbonate, while the electrode materials are ceramic or metal (but not precious metal). High operation temperature fuel cells allow internal reforming, promote rapid kinetics with non-precious materials and offer high flexibilities in fuel choice, and are potential and viable candidate to moderate the fast increase in power requirements and to minimize the impact of the increased power consumption on the environment. 'Materials for High Temperature Fuel Cells' is part of the series on Materials for Sustainable Energy and Development edited by Prof. Max Q. Lu. The series covers advances in materials science and innovation for renewable energy, clean use of fossil energy, and greenhouse gas mitigation and associated environmental technologies.

Springer

Reviews the science and engineering of high-temperature corrosion and provides guidelines for selecting the best materials for an array of system processes High-temperature corrosion (HTC) is a widespread problem in an array of industries, including power generation, aerospace, automotive, and mineral and chemical processing, to name a few. This book provides engineers, physicists, and chemists with a balanced presentation of all relevant basic science and engineering aspects of high-temperature corrosion. It covers most HTC types, including oxidation, sulfidation, nitridation, molten salts, fuel-ash corrosion, H<sub>2</sub>S/H<sub>2</sub> corrosion, molten fluoride/HF corrosion, and carburization. It also provides corrosion data essential for making the appropriate choices of candidate materials for high-temperature service in process conditions. A form of corrosion that does not require the presence of liquids, high-temperature corrosion occurs due to the interaction at high temperatures of gases, liquids, or solids with materials. HTC is a subject is of increasing importance in many areas of science and engineering, and students, researchers, and engineers need to be aware of the nature of the processes that occur in high-temperature materials and equipment in common use today, especially in the chemical, gas, petroleum, electric power, metal manufacturing, automotive, and nuclear industries. Provides engineers and scientists with the essential data needed to make the most informed decisions on materials selection Includes up-to-date information accompanied by more than 1,000 references, 80% of which from within the past fifteen years Includes details on

systems of critical engineering importance, especially the corrosion induced by low-energy radionuclides Includes practical guidelines for testing and research in HTC, along with both the European and International Standards for high-temperature corrosion engineering Offering balanced, in-depth coverage of the fundamental science behind and engineering of HTC, High Temperature

Corrosion: Fundamentals and Engineering is a valuable resource for academic researchers, students, and professionals in the material sciences, solid state physics, solid state chemistry, electrochemistry, metallurgy, and mechanical, chemical, and structural engineers.

Related with Oxide Scale Behavior In High Temperature Metal Processing:

- Dna Structure And Replication Worksheet : [click here](#)