Corrosion resistance of stainless steels at elevated temperatures

**Corrosion Resistance of Stainless Steels in Sea Water**

Duplex Stainless Steels (DSSs) are chromium-nickel-molybdenum-iron alloys that are usually in proportions optimized for equalizing the volume fractions of austenite and ferrite. Due to their ferritic-austenitic microstructure, they possess a higher mechanical strength and a better corrosion resistance than standard austenitic steels. This type of steel is now increasing its application and market field due to its very good properties and relatively low cost. This book is a review of the most recent progress achieved in the last 10 years on the use of duplex stainless steel in different applications. Special attention was given to the welding characteristics, resistance to stress corrosion cracking, and general corrosion behavior of the material. It is an important guide for researchers in the field of stainless steel and engineers searching for answers to practical problems.

**Localized Corrosion Resistance of Stainless Steels in Chloride Solution**

Stainless steels represent a quite interesting material family, both from a scientific and commercial point of view, following to their excellent combination in terms of strength and ductility together with corrosion resistance. Thanks to such properties, stainless steels have been indispensable for the technological progress during the last century and their annual consumption increased faster than other materials. They find application in all these fields requiring good corrosion resistance together with ability to be worked into complex geometries. Despite to their diffusion as a consolidated materials, many research fields are active regarding the possibility to increase stainless steels mechanical properties and corrosion resistance by grain refinement or by alloying by interstitial elements. At the same time innovations are coming from the manufacturing process of such a family of materials, also including the possibility to manufacture them starting from metals powder for 3D printing. The Special Issue scope embraces interdisciplinary work covering physical metallurgy and processes, reporting about experimental and theoretical progress concerning microstructural evolution during processing, microstructure-properties relations, applications including automotive, energy and structural.

**Introduction to Stainless Steels**

**Welding Metallurgy of Stainless Steels**

The corrosion resistances of several grades of austenitic stainless steels were determined in the boiling nitric acid test (Huey test) and compared with the corrosion resistances of these same steels in sulfuric acid solutions. Steels showing the least corrosion resistance in the nitric acid test generally proved to be the most resistant to sulfuric acid. Specimens of types 304 and 316 stainless steel in both the annealed and sensitized conditions also were exposed to the boiling nitric acid test and to boiling solutions of lactic, phosphoric, and acetic acids. The type 316 steel proved to be less resistant to nitric acid, but in most cases was definitely more resistant to the boiling acids than the type 304 steel. However, microscopic examination indicated that the types of attack which developed in the annealed or sensitized types 304 and 316 specimens in the boiling nitric acid test were qualitatively similar to the types of attack which developed in similar specimens in the other boiling acids, provided any attack developed.
Stainless Steels with High Strength and High Corrosion Resistance

Corrosion Resistance of Nickel-containing Alloys in Organic Acids and Related Compounds

ASM Specialty Handbook® Stainless Steels The best single-volume reference on the metallurgy, selection, processing, performance, and evaluation of stainless steels, incorporating essential information culled from across the ASM Handbook series. Includes additional data and reference information carefully selected and adapted from other authoritative ASM sources.

Evaluation of the Localized Corrosion Resistance of 21cr Stainless Steels

Corrosion Resistance of Steels, Nickel Alloys, and Zinc in Aqueous Media

The Influence of Copper Addition on the Corrosion Resistance of Stainless Steels

Avoids most of the advanced technical aspects, language, derivations, and premises to present an introduction for readers new to metals entirely or to stainless steel in particular. Discusses what stainless steels are and what they do, their history, some metallurgical principles, principles of cor

A Century of Stainless Steels

A Complete, Up-to-Date Introduction to Corrosion of Stainless Steels and Metallurgical Factors This fully updated Second Edition of Corrosion of Stainless Steels covers the tremendous advances made with stainless steels in recent decades, including applications in many new areas—from marine technologies and off-shore oil production to power plants and the kitchen sink. This book offers unique insights into the corrosion mechanisms affecting stainless steels, details problem-avoidance strategies, and helps identify corrosion-resistant capabilities for these remarkable alloys Sponsored by the Electrochemical Society, Corrosion of Stainless Steels Provides a comprehensive introduction to the selection, development, and production of all types of stainless steels Emphasizes how metallurgical factors affect corrosion resistance Examines the limitations of stainless steels within the context of a discussion on higher alloys Takes an interdisciplinary approach that demonstrates the combined effects of metallurgy, chemistry, and electrochemistry on corrosion resistance Provides baseline knowledge and testing standards for stainless steels, and facilitates failure analysis for industrial purposes or litigation related to equipment failure This is a much-needed text for materials scientists, chemical engineers, corrosion specialists, graduate students, and anyone who needs to be brought up to date on this subject.

Corrosion Resistance of Stainless Steels

Nature of the Corrosion Resistance of Stainless Steels

Improved Pitting and Crevice Corrosion Resistant High Alloy Austenitic Stainless Steel for Service in Seawater and Other Chloride Environments

Effects of Surface Treatment on Corrosion Resistance of Stainless Steels

The Corrosion Resistance of Stainless Steels

This comprehensive study covers all types of corrosion of austenitic stainless steel. It also covers methods for detecting corrosion and investigating corrosion-related failure, together with guidelines for improving corrosion protection of steels. Details all types of corrosion of austenitic stainless steel Covers methods for detecting corrosion and investigating corrosion-related failure Outlines guidelines for improving corrosion protection of steels

Nature of the Corrosion Resistance of Stainless Steels

Manufacturing and Application of Stainless Steels

Crevice Corrosion Resistance of Stainless Steels in Waters Containing Chloride and Sulfate Ions
Normally, stainless steel is utilized without any type of coating whatsoever. However, there are occasions where coatings may be contemplated. One of present interest to the U.S. Navy is that associated with the use of antifouling coatings on ship hulls fabricated of non-magnetic, austenitic stainless steel. Testing in natural seawater has demonstrated that coatings can protect susceptible stainless steel from barnacle related crevice corrosion and localized corrosion at weldments. However, coating defects and damage create new areas for crevice corrosion to initiate. As discussed in an earlier project report documenting contract N00014-97-C-0216, specimens of several grades of stainless steel were extremely susceptible to crevice corrosion when partially coated with epoxy alone, or when top coated with antifouling paints of the ablative-Cu and elastomeric types. The use of zinc-rich primers is known to enhance resistance to crevice corrosion, but their use raises other issues. Of chief concern is the possibility of liquid metal embrittlement if the stainless steel were ever heated above the melting temperature for zinc. This current project addresses the alternate use of organic silane type coatings. Ideally, silane would eliminate the need for a zinc-rich primer and the epoxy barrier coating. Current test results show promise when silane is applied as an ultra-thin film on non-stainless steel. Additional testing is proposed to resolve potential problems when silane + ablative-Cu coated stainless steel is subjected to cathodic protection. Because of the apparent lack of insulation provided by the thin-film silane, cathodic disbondment of the topcoat has been observed.

**Corrosion Resistance of Stainless Steels**

**Corrosion Resistance of the Austenitic Chromium--nickel Stainless Steels in High Temperature Environments**

**Corrosion Resistance of Stainless Steels (Jan 73 - Present)**

When considering the operational performance of stainless steel weldments the most important points to consider are corrosion resistance, weld metal mechanical properties and the integrity of the welded joint. Mechanical and corrosion resistance properties are greatly influenced by the metallurgical processes that occur during welding or during heat treatment of welded components. This book is aimed, therefore, at providing information on the metallurgical problems that may be encountered during stainless steel welding. In this way we aim to help overcome a certain degree of insecurity that is often encountered in welding shops engaged in the welding of stainless steels and is often the cause of welding problems which may in some instances lead to the premature failure of the welded component. The metallurgical processes that occur during the welding of stainless steel are of a highly intricate nature. The present book focuses in particular on the significance of constitution diagrams, on the processes occurring during the solidification of weld metal and on the recrystallization and precipitation phenomena which take place in the area of the welds. There are specific chapters covering the hot cracking resistance during welding of stainless steel, welding of a number of different stainless steel grades. In addition, recommendations are given as to the most suitable procedures to be followed in order to obtain maximum corrosion resistance and mechanical properties from the weldments.

**Stainless Steels**

**Corrosion Resistance of the Austenitic Chromium-nickel Stainless Steels in Atmospheric Environments**

**Austenitic Stainless Steels**

**STANDARD Test Methods For Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution**

**Corrosion of Austenitic Stainless Steels**

Abstract: Ferritic stainless steels have good corrosion resistance properties and lower cost than austenitic steels due to the lack of nickel. However, they have a lower formability than that of austenitics, and they show brittleness at low temperatures, near 475°C, and of welds. Pohang Steel Company (POSCO) has interest in a 21% Cr ferritic stainless steel, which is a concentration that is relatively unexplored. Pitting corrosion of stainless steels is associated with surface defects and heterogeneities in the matrix, in particular inclusions, however, there is little information about the initiation sites in clean steels, with low S content. Therefore, it is of interest to investigate where the most susceptible sites for pitting initiation are located, and the role they play. The corrosion resistance of the ferritic alloys is evaluated and compared to the performance of austenitic SS304 steel using crevice corrosion tests and cyclic polarization tests in chloride solution to determine the pitting and repassivation potentials of the alloys. The role that inclusions play during pitting was evaluated for the ferritic stainless steels through a chemical attack experiment where the alloys were exposed to an acidic chloride solution and the progression of the attack was assessed at defined inclusions and discrete time intervals. The pitting potential (Epit) distribution of the ferritic alloys shows values ranging from 100 mV to 450 mV higher than those observed on SS304, indicating a higher resistance to pit initiation for the ferritic steels. In the crevice corrosion test, SS304 showed higher repassivation potentials (Erep) than the ferritic steels and in the pitting corrosion test the Erep values were higher for the ferritic steels. In both cases, however, the difference in Erep was about 100 mV. The differences in Erep between crevice and pitting may be caused by a strong dependence of Erep on the charge density in the low charge density region associated to pitting. The attack under a crevice former has larger dimensions than a pit, and thus the crevice repassivation potential might be different than that for pits. The higher repassivation potential for deep crevices found for SS304 indicates a better resistance to localized corrosion propagation. The combination of this result with the higher pitting potentials for the ferritic stainless steels suggests that the localized corrosion resistance of the
Weldability of Stress Corrosion Resistant Stainless Steels

Seawater Crevice Corrosion Resistance of Stainless Steels Coated with Silane and Antifouling Paint Systems

Corrosion Resistance of Stainless Steels

The Corrosion Resistance of Stainless Steels in Hypochlorite Solutions

Crevice corrosion behavior for a series of austenitic and duplex stainless alloys was determined in a number of simple solutions as well as in diluted natural seawater containing up to 10 g/L Cl- and 10 g/L SO4=2-. Remote crevice assembly technology using zero resistance ammeters revealed differences in initiation and propagation resistance. Effects of solution ion concentration, alloy composition and the influence of crevice geometry and biological activity are discussed.

Corrosion Resistance of Stainless Steels

At the completion of one century of discovery of stainless steels, it is appropriate to take stock of the latest trends in wide ranging fields that relate to stainless steels. The book covers advances in all the major aspects related to stainless steels namely melting & refining, fabrication & forming, welding & joining, physical metallurgy, corrosion and its control and experience from use of stainless steels in various industries including newer varieties of stainless steels. The book will be a good source of information regarding various aspects of stainless steels. Volume is indexed by Thomson Reuters CPCI-S (WoS).

Corrosion Resistance of Stainless Steels (Jan 73 - Present)

Powder Metallurgy Stainless Steels

Duplex Stainless Steels

Corrosion Resistance of the Austenitic Chromium-nickel Stainless Steels in Chemical Environments

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 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.

Corrosion Resistance of Stainless Steels

Corrosion Resistance of Stainless Steels

This work examines the corrosion of stainless steels and similar chromium-bearing nickel-containing higher alloys, detailing various corrosive environments, including atmospheric and fire-side corrosion, corrosion by water and soil, and corrosion caused by particular industrial processes. It presents the acceptable isocorrosion parameters of concentration and temperature for over 250 chemicals for which stainless alloys are the preferred materials of construction.

Corrosion of Stainless Steels

Stainless Steels in Architecture, Building and Construction

Comparative Corrosion Resistance of Stainless Steels in Various Acids