

Introduction to welding for offshore applications



Welding metallurgy – stainless steels

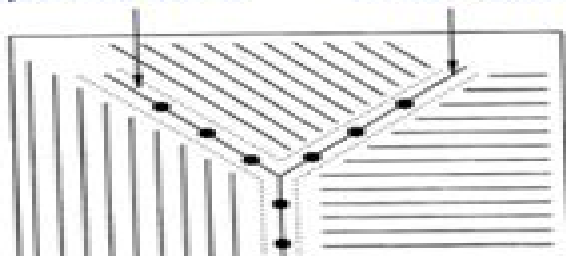
Morten Johnsrud
2010-11-03

Austenitic stainless steels

Main issues:

- Maintenance of uniform corrosion resistance across the weld zone
- Chrome carbide depletion → sensitive to intergranular corrosion in service

Cr depleted zone Grain boundary



Welding Metallurgy Of Stainless Steels

**Leif Karlsson, Welding Research
Council (U.S.), International Institute
of Welding**



Welding Metallurgy Of Stainless Steels:

Welding Metallurgy of Stainless Steels Erich Folkhard, 2012-12-06 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 and the practical 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

Welding Metallurgy of Stainless Steels G Rabensteiner, E Perteneder, H Schabereiter, 1988-07-18 Welding Metallurgy and Weldability of Stainless Steels John C. Lippold, Damian J. Kotecki, 2005-04 This book describes the fundamental metallurgical principles that control microstructure and properties of welded stainless steels It also serves as a practical how to guide that allows engineers to select the proper alloys filler metals heat treatments and welding conditions to insure that failures are avoided during fabrication and service *Welding Metallurgy of Stainless and Heat-Resisting Steels* R. Castro, J. J. de Cadanet, 1975-05-22 **Welding Metallurgy and Weldability** John C. Lippold, 2014-11-10 Describes the weldability aspects of structural materials used in a wide variety of engineering structures including steels stainless steels Ni base alloys and Al base alloys Welding Metallurgy and Weldability describes weld failure mechanisms associated with either fabrication or service and failure mechanisms related to microstructure of the weldment Weldability issues are divided into fabrication and service related failures early chapters address hot cracking warm solid state cracking and cold cracking that occur during initial fabrication or repair Guidance on failure analysis is also provided along with examples of SEM fractography that will aid in determining failure mechanisms Welding Metallurgy and Weldability examines a number of weldability testing techniques that can be used to quantify susceptibility to various forms of weld cracking Describes the mechanisms of weldability along with methods to improve weldability Includes an introduction to weldability testing and techniques including strain to fracture and Varestraint tests Chapters are illustrated with practical examples based on 30 plus years of experience in the field Illustrating the weldability aspects of structural materials used in a wide

variety of engineering structures Welding Metallurgy and Weldability provides engineers and students with the information needed to understand the basic concepts of welding metallurgy and to interpret the failures in welded components

Welding Metallurgy of Stainless Steels Robert D. Davis,1953 **Properties of austenitic stainless steels and their weld metals (influence of slight chemistry variations).** C. R. Brinkman,1979 **Welding Metallurgy** Sindo Kou,1987-09-14 Presents the fundamental aspects of fusion welding for students and serves as a handy reference for practicing engineers and research workers involved with the welding of engineering alloys Deals with the metallurgy of welding complementing existing welding handbooks and manuals which tend to emphasize procedures for welding various materials Examines the thermal chemical and mechanical aspects of welding the metallurgical aspects of welding in three different regions of the weld the fusion the partially melted and the heat affected zones and the microstructure and properties of the weld Outlines the difficulties in producing sound welds and practical approaches to overcome them Also covers several important alloy systems and their representative heat affected zone phenomena Includes numerous examples problems and case studies and contains extensive references to the literature A Review of the Welding Metallurgy and Weldability of Ferritic Stainless Steels J. C. Lippold,1991 **Welding Metallurgy of Stainless and Heat-Resisting Steels** Rene Castro,J. J. De Cadenet,1975 **Powder Metallurgy Stainless Steels** Erhard Klar,Prasan K. Samal,2007-01-01

Fundamentals of Welding Metallurgy Henry Granjon (Metallurgist, France),1991 This book describes all the metallurgical phenomena involved in the different welding processes Practical examples of a wide variety of metals and alloys are provided as well as an expert commentary on steel weldability and types of cracking It is possible to weld materials as diverse as stainless steels zirconium titanium and uranium but it is crucial to understand the chemical reactions likely in the surrounding welding atmosphere This book describes all the metallurgical phenomena involved in different welding processes from the most standard to the most modern such as electron beam welding or high energy laser welding

Welding Metallurgy of Stainless Steels Welding Institute Staff,1994-01-01 *Welding Metallurgy of Steels* Canadian Western Bank. Industry Services,2010 Most stainless steels are readily welded but only if the correct consumable and procedure are used The special properties of stainless steel allow it to be used in a wide variety of aggressive environments The incorrect welding of this material can lead to rapid corrosion and potentially early failure This module will provide the user with the information necessary to make sound welding decisions relating to stainless steel fabrication website

Welding Metallurgy of Structural Steels Jay Y. Koo,1987 **Introductory Welding Metallurgy** Arthur L. Phillips,1968

Corrosion of Weldments Joseph R. Davis,2006-01-01 Corrosion failures of industrial components are commonly associated with welding The reasons are many and varied For example welding may reduce the resistance to corrosion and environmentally assisted cracking by altering composition and microstructure modifying mechanical properties introducing residual stress and creating physical defects This book details the many forms of weld corrosion and the methods used to

minimize weld corrosion Chapters on specific alloys groups carbon and alloy steels stainless steels high nickel alloys and nonferrous alloys describe both general welding characteristics and the metallurgical factors that influence corrosion behavior Corrosion problems associated with dissimilar metal weldments are also examined Case histories document corrosion problems unique to specific industries including oil and gas chemical processing pulp and paper and electric power Special challenges caused by high temperature environments are discussed Commonly used methods to monitor weld corrosion and test methods for evaluation of intergranular pitting crevice stress corrosion cracking and other forms of corrosion are also reviewed

Intermetallic Phase Precipitation in Duplex Stainless Steels and Weld Metals Leif Karlsson, Welding Research Council (U.S.), International Institute of Welding, 1999-01-01 This report reviews formation and effects of deleterious phases in complex stainless steels and weld metals Emphasis is on precipitation of intermetallic phases and their influences on mechanical properties and corrosion resistance Other secondary phases such as carbides nitrides and secondary austenite are also discussed since these often coexist with intermetallic phases and in many cases they influence nucleation and growth rates of these as well as having a significant effect on properties The influence of welding procedure and weld metal chemistry on precipitation behavior is considered Practical detection of intermetallic phases and how to define realistic acceptance criteria is covered The study concentrates on wrought duplex stainless steels and weld metals although most results can be applied to cast material The report concludes that metallographic evaluation can provide useful information about the presence and location of intermetallic precipitates in welded joints but the evaluation is subject to interpretation Evidence exists that some intermetallics can in most cases be tolerated Acceptance of welding procedures should therefore preferably be based on direct measurement of the properties of practical concern

Metallurgy of Welding J. F. Lancaster, 1999-05-25 A new edition of a well established and respected textbook from an author who is a recognised authority in this field Joining techniques are one of the key technologies in materials engineering and this book provides comprehensive coverage of the subject It is intended for undergraduate and graduate students of metallurgy as well as those attending specialist welding courses It is also a valuable source of reference for practising engineers and metallurgists concerned with joining processes The text covers the metallurgical changes that take place during the welding process the properties of welded joints defects associated with welding and the behaviour of welded joints in service There is a chapter devoted to joints between metals and ceramics and on the use of structural adhesives The various techniques used in microwelding and the joining of solid state devices to printed circuit boards are briefly described In addition to revising and updating the text throughout the author has made some specific alterations and additions to the book Brittle and ductile behaviour of solids ductile fracture and the velocity of crack propagation are now included in the section on Fracture Friction stir welding is now included There is an additional chapter on adhesive bonding which includes bonding forces polymer chemistry types of adhesive production technology quality control and applications The section on heat flow has

been expanded and includes worked examples A section on weld defects and the evaluation of non destructive tests has been added A section on the welding metallurgy of aluminium lithium alloys has been added A new section describes major structural failure in such catastrophes as the Alexander L Kielland accident and the Kobe earthquake and considers the role of welding in such failures

Stainless Steels Joseph R. Davis, 1994 Contents Include introduction to Stainless Steels Metallurgy and properties of wrought and cast stainless steels powder metallurgy melting refining and recycling Corrosion Behaviour Atmospheric and aqueous corrosion stress corrosion cracking and hydrogen embrittlement high temperature corrosion corrosion of cast stainless corrosion of weldments Fabrication and Finishing Foundry practice forming forging and extrusion PM processing heat treating machining welding brazing and soldering adhesive bonding surface engineering Metallography Microstructures and Phase Diagrams Metallographic practices and microstructures of wrought stainless metallography and microstructures of cast stainless phase diagrams Properties of Stainless Steels Physical properties low temperature properties elevated temperature properties tribological properties Also includes index

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