

96-0539 **Materials Selection for Corrosion Control.** (Book). Oxidation of metals, electrochemical principles of corrosion, passivity, and factors influencing corrosion and its forms are described. Means for corrosion monitoring and inspection are discussed. Corrosion characteristics of ferrous alloys (carbon, high-strength, low-alloy and stainless steels, cast iron), nonferrous metals and alloys (Al, Cu, Pb, Mg, Ni, Ti, Zn, and special-purpose metals), nonmetallic materials (polymers, ceramics, carbon and graphite, and composites) are examined. Corrosion control measures via cathodic and anodic protection, inhibitors, protective coatings, linings and claddings, and surface modification are addressed. Sections are devoted to techno-economic selection of materials for use in corrosive environments and computer-assisted materials selection. Graphs. 923 ref.

S.L. Chawla and R.K. Gupta (University of Michigan). ASM International, Member/Customer Service Center, Materials Park, OH 44073-0002, USA, 1993, Pp 508, 7 1/4 in. x 10 1/2 in., illustrated, [in English].

96-0540 **Basic Corrosion Technology for Scientists and Engineers.** (Book).

E. Mattsson (Swedish Corrosion Institute). *Basic Corrosion Technology for Scientists and Engineers*, Ellis Horwood Limited, Market Cross House, Cooper St., Chichester, West Sussex, PO19 1EB, UK, 1989, (Met.A., 199510-72-0336) Pp 193, 6 3/4 x 9 3/4 in., illustrated, [in English]. ISBN 0-7458-0686-4.

96-0541 **DECHEMA Corrosion Handbook. Corrosive Agents and Their Interaction With Materials. Vol. 12. Chlorinated Hydrocarbons—Chloroethanes; Phosphoric Acid.** (Handbook). The contents of this handbook are arranged in alphabetical order of the corrosive media, each chapter being subdivided as follows: (a) metallic materials; (b) nonmetallic inorganic materials; (c) organic materials; (d) materials with special properties. Each chapter is preceded by a survey table showing a rough assessment of the behaviour of each material in contact with the title compounds. Graphs. 698 ref.

G. Kreysa and R. Eckermann. 12, VCH Verlagsgesellschaft mbH, Postfach 10 11 61, Weinheim, D-6940, Germany, 1993, Pp ix + 351, [in English]. ISBN 3-527-26663-1.

96-0542 **Modeling geological brines in salt-dome high level nuclear waste isolation repositories by artificial neural networks.** In order to study the influence of various parameters on the acidity of simulated geological brines, an artificial intelligence technique based on neural network modeling has been developed. It has been found that the pH of simulated salt repository brines lies within the range of 3.2-5 as the temperature of the brine decays from 250 to 125°C. This environment might cause severe corrosion damage to canisters fabricated from carbon steel, particularly under slightly oxidizing conditions because of autocatalytic attack. It has also been demonstrated that artificial neural networks are efficient tools for analysing complex chemical systems, especially when conventional modeling is precluded by a lack of knowledge of the species and equilibria involved in the system. Graphs. 7 ref.

M. Ben-Haim (Nuclear Research Centre Negev) and D.D. Macdonald (Pennsylvania State University). *Corros. Sci.*, Feb. 1994, 36, (2), 385-393, [in English]. ISSN 0010-938X.

96-0543 **Corrosion-Resistant Coatings Technology.** (Book).

I. Suzuki (University of Tokyo). *Corrosion-Resistant Coatings Technology*, Marcel Dekker, Inc., 270 Madison Ave., New York, New York 10016, USA, 1989, (Met.A., 199510-72-0341) Pp 266, 6 1/4 x 9 1/4 in., illustrated, \$99.75 (US and Canada), \$119.50 (all other countries), [in English]. ISBN 0-8247-8160-0.

96-0544 **Galvanic protection of steel and galvanic corrosion of zinc under thin layer electrolytes.** The potential and galvanic current distribution of a Zn/steel (low carbon) couple under thin layer electrolytes of dilute Na₂SO₄ were measured using a coplanar galvanic cell, and were found to be sensitively dependent on electrolyte thickness, electrolyte concentration, steel surface area, and distance between Zn and steel. On steel, the potential varied strongly but the current was relatively constant across the surface. On Zn, the potential varied little but the current changed sharply across the surface. The anodic current was mostly concentrated at the edge of the Zn electrode closest to the Zn/steel boundary. The galvanic protection distance for steel and the galvanic corrosion current of Zn were quantitatively determined for the various parameters of the system. Graphs. 16 ref.

X.G. Zhang (COMINCO Product Technology Centre) and E.M. Valente. *Corros. Sci.*, Dec. 1993, 34, (12), 1957-1972, [in English]. ISSN 0010-938X.

96-0545 **Basic Corrosion Technology for Scientists and Engineers.** (Book). Basic electrochemical concepts and types of corrosion are described. Characteristics of corrosion environments and means of corrosion protection are discussed. Corrosion properties of steel and cast iron, stainless steel, Al and its alloys, and Cu and its alloys are considered. Methodology of corrosion testing and monitoring is addressed. Corrosion information sources are identified. Photomicrographs, Graphs, Maps. 18 ref.

E. Mattsson (Swedish Corrosion Institute). *Basic Corrosion Technology for Scientists and Engineers*, Ellis Horwood Limited, Market Cross House, Cooper St., Chichester, West Sussex, PO19 1EB, UK, 1989, (Met.A., 199510-72-0336) Pp 193, [in English].

96-0546 **Regional and microclimatic pollution effects on atmospheric corrosion in Prague and Europe.** Atmospheric corrosion test results for structural metals in open air and under shelter from multilateral European programs (1968-1992) are presented and the effects of SO₂ pollution analyzed. Regional and microclimatic pollution effects are documented by test results from Czech permanent test sites, test sites throughout Prague, and test sites on the St. Vitus Cathedral. The effects of variations in pollution activity, time of wetness, and type of metal are considered. Data is given for unalloyed steels and aluminum. Graphs. 15 ref.

D. Knotkova (SVUOM) and K. Kreislova, J. Vlkova (SVUOM). *Mater. Perform.*, June 1995, 34, (6), 41-47, [in English]. ISSN 0094-1492.

96-0547 **Glycol coolants improve heat transfer and corrosion control.** Glycol-based fluids have proven to be effective as coolants in large stationary diesel engines used to drive compressors on natural gas pipeline distribution systems. With the proper formulation, they have high heat transfer coefficients and are good corrosion inhibitors. Special glycol based heat transfer fluids have been developed especially for long term applications in gas compressor engines. There are propylene and ethylene glycols and both have similar properties. The advantages of both types of fluids are discussed. For example, the toxicity of propylene glycols is significantly less than that of ethylene glycols. Also, it generally causes less cavitation corrosion. Ethylene glycol, on the other hand is better where low temperatures can be expected. Both types of fluids require inhibitors to reduce their corrosive tendencies.

R. Hotfield (Dow Chemical). *Pipeline Gas J.*, Mar. 1995, 222, (3), 28-30, [in English]. ISSN 0032-0188.

96-0548 **The role of dispersoids in maintaining the corrosion resistance of mechanically alloyed oxide dispersion strengthened alloys.** When exposed in air, aluminum was lost from the bulk of MA ODS alloys to the growth of a surface alumina film. The extent of aluminum lost was dependent on the section thickness and could significantly affect the volume fraction of the aluminum rich dispersoids. Two ferritic MA ODS alloys namely MA956 bar and ODM751 tube were used in the experiments. Coarsening of the dispersoids at temperatures up to 1200°C in the thick MA956 bar occurred without significant aluminum loss, while their volume fraction increased continuously. However, coarsening of the dispersoids in the thinner ODM751 tube at 1200 and 1300°C was accompanied by dissolution of the dispersoid particles in order to maintain the aluminum concentration in the matrix. Graphs. 15 ref.

Scr. Metall. Mater., 15 May 1995, 32, (10), 1585-1588, [in English]. ISSN 0956-716X.

Ferrous metals/Eisenmetalle

96-0549 **Steel protection from hydrogen sulfide-induced corrosion with the use of bactericides.** A combining low effective inhibitors with the bactericides improves anticorrosion properties through synergism. New inhibitors-bactericides Araz-1 and INFKh-4 are recommended to prevent the corrosion of oil field equipment because of hydrogen sulfide and sulfate reducing bacteria. The commercial tests showed high efficiency of corrosion retardation in two-phase hydrocarbon-electrolyte media saturated with H₂S. Graphs, Numerical Data. 4 ref.

V.M. Abbasov, E.Sh. Abdullaev, I.A. Mamedov. *Zashch. Met.*, Mar.-Apr. 1995, 31, (2), 206-208, [in Russian]. ISSN 0044-1856.

96-0550 **Corrosion investigation of high alloyed steels in sea water below fouling.** The local corrosion of Kh18N10T and 12Kh18N10T high alloyed steels was studied induced by the seaweed fouling. Microscopic investigations showed that both living and dead animals initiated the corrosion. In either case the metabolic activity bacteria is an original cause of local depassivation of the steel surface under anaerobiosis conditions below animals. Graphs, Numerical Data. 11 ref.

N.Yu. Filonenko, Yu.M. Kaplin, M.D. Koryakov (Academy of Sciences of Russia). *Zashch. Met.*, Mar.-Apr. 1995, 31, (2), 219-221, [in Russian]. ISSN 0044-1856.

96-0551 **The effects of complexing agents on the corrosion of iron in an anhydrous methanol solution.** Polarization curves of an Fe electrode in an anhydrous methanol solution of 0.1M LiClO₄ containing various basic and acidic complexing agents (water content < 150 ppm) were discussed with respect to the proton concentration in methanol, the stability constant of the ferrous complex and x-ray photo-electron spectra of the electrode surface treated with the complexing agents. Because most of the cathodic polarization curves were independent of the proton concentration in the methanol solution, a cathodic reaction of methanol being directly reduced to form a hydrogen molecule and methoxide ion was proposed. The anodic process was stimulated with the complexing agent by the formation of a soluble complex in the solution. The stimulation of the anodic process is closely associated with the stability constant of the complex. Both cathodic and anodic processes were suppressed when a layer of the complex deposit formed on the surface. Graphs, Spectra. 21 ref.

M. Sakakibara (Keio University) and K. Aramaki, H. Nishihara. *Corros. Sci.*, Dec. 1993, 34, (12), 1937-1946, [in English]. ISSN 0010-938X.

96-0552 **The long term growth of the protective rust layer formed on weathering steel by atmospheric corrosion during a quarter of a century.** The rust layers formed on weathering and mild steels by atmospheric corrosion in an industrial region for a quarter of a century have been characterized using various analytical techniques. In particular, analysis of a local portion of the rust layers by means of Raman spectroscopy gives important information on the structure of the layers. It is elucidated that the inner stable and protective rust layer which covered the surface of weathering steel mainly consists of nano-particles of α -FeOOH containing a considerable amount of Cr. The relative change of the amount of rust constituents for low alloy steels supports well a newly proposed schematic progress of long term alteration in stable and protective rust layer formed on a weathering steel in an industrial environment, i.e. the γ -FeOOH, as an initial rust layer, is transformed into a final stable rust layer of α -FeOOH, probably via an amorphous oxyhydroxide substance, during the long term atmospheric corrosion of a weathering steel. Diffraction Patterns, Spectra, Photomicrographs, Graphs. 38 ref.

M. Yamashita (Sumitomo Metal Industries) and Y. Matsuda, H. Miyuki, H. Nagano, T. Misawa (Muran Institute of Technology). *Corros. Sci.*, Feb. 1994, 36, (2), 283-299, [in English]. ISSN 0010-938X.

- 96-0553 **Environmental Cracking of AISI 4145 Steel in Drilling Muds.** (Conference Paper). The environmental cracking of a quenched and tempered AISI 4145 steel in a water-based drilling mud has been investigated under slow strain-rate tensile and cyclic-loading conditions. The variables investigated were pH, potential, temperature and the addition of copper- and zinc-containing lubricants. These tests were supported by detailed electron fractography. Under tensile loading conditions, progressive loss of ductility occurs with decreasing potential and pH, and with increasing temperature. The addition of 25 wt.% Cu- and Zn-containing lubricants generally reduces this embrittlement. The corrosion fatigue crack propagation rate increases with decreasing potential and pH. At low ΔK values, temperature does not affect the corrosion fatigue crack propagation rate; it is accelerated by increasing temperature at higher ΔK values, but temperature does not affect it at higher ΔK values. It is concluded that the decrease in ductility and the increase in the fatigue crack growth rates in drilling muds, relative to air, are due to the appearance of brittle forms of fracture (intergranular transgranular and quasi-cleavage fracture modes) which are the result of H-induced cracking. Graphs. 6 ref.
- ... Gonzalez-Rodriguez (Instituto de Investigaciones Electricas) and R.P.M. Procter (UMIST). Advances in Corrosion and Protection [Proc. Conf.], Manchester, United Kingdom, 28 June-3 July 1992, *Corros. Sci.*, 1993, 35, (1-4), Pergamon Press Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, United States, 1993, (Met.A., 199408-72-0541) 515-520, [in English]. ISSN 0010-938X.
- 96-0554 **An Analytical Electron Microscopy Study of the Role of Lanthanum and Yttrium During High-Temperature Oxidation of Selected Nickel-Base Alloys.** It was the objective of this study to determine the atomic-scale distribution of active elements in wrought Ni-base alloys using analytical electron microscopy techniques. Two alloys representing Al_2O_3 -forming and Cr_2O_3 -forming alloys were selected for study. Yanes alloy 214 is a Y-containing alloy capable of developing Al_2O_3 scale at temperatures $> 1000^\circ C$ and Haynes alloy 230 is a La-containing alloy protected by Cr_2O_3 scale. Sheet samples of both alloys were oxidized for 1000 h at $1150^\circ C$ in air. It was found that Y segregation to grain boundaries of Al_2O_3 scale developed by alloy 214 was the major contributing factor to its improved high-temperature oxidation resistance. Similar benefits would be expected to result from La segregation to grain boundaries of Cr_2O_3 scale in the case of Alloy 230. However, other beneficial effects could be produced by the partial presence of La in the form of $LaCrO_3$ particles, such as blocking chromium transport, which reduces the scale growth rate. Photomicrographs, Diffraction Patterns. Graphs. 30 ref.
- H.M. Tawancy (King Fahd University of Petroleum and Minerals) and N.M. Abbas (King Fahd University of Petroleum and Minerals). *Scr. Metall. Mater.*, 1 Sept. 1993, 29, (5), 689-694, [in English]. ISSN 0956-716X.
- 96-0555 **The Pitting Corrosion of Plasma Nitrided Chromium Steels in Sulphate Solution.** (Conference Paper). 3Cr—Mo and 17Cr—2Ni steels were plasma nitrided in two nitrogen—hydrogen gas mixtures containing 25% and 80% N, respectively. Anodic polarization curves were measured at various depths of the nitrided layers in 0.05 M Na_2SO_4 solution, acidified to pH 3.0, at $25^\circ C$. The outer nitride zones and the adjacent thin regions, up to ~ 10 μm in depth, showed good corrosion resistance and ability to passivate. The diffusion zones in both steels underwent pitting corrosion and/or uniform corrosion, depending on the depth. Pitting occurred at depths of ~ 10-30 μm , whereas considerable dissolution with pin point etching was observed in deeper regions. It was presumed that pitting corrosion of the intermediate regions in the halide-free solution appeared under conditions of oxide film formation in the presence of sulphate salt films. Graphs. 19 ref.
- J. Mankowski (Polish Academy of Sciences) and J. Flis (Polish Academy of Sciences). Advances in Corrosion and Protection [Proc. Conf.], Manchester, United Kingdom, 28 June-3 July 1992, *Corros. Sci.*, 1993, 35, (1-4), Pergamon Press Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, United States, 1993, (Met.A., 199408-72-0541) 111-116, [in English]. ISSN 0010-938X.
- 96-0556 **Validation of the Role of Bulk Charging of Hydrogen in the Corrosion Fatigue Cracking of Low Alloy Steel.** The enhanced corrosion fatigue crack growth rates of low alloy steels cathodically protected in marine environments result from absorbed H atoms. Hydrogen atoms are generated at the crack tip, crack walls and the external surface of the specimen (bulk charging). The purpose of the study was to verify experimentally the importance of bulk charging. Corrosion fatigue tests were made on AISI 4340 steel samples which had been heat treated. The results showed that bulk charging had a significant effect on the corrosion fatigue crack growth rates of AISI 4340 steel in 3.5 wt.% NaCl at -1100 mV(SCE), confirming the prediction that the external surface of the specimen can be a main source of H atoms under cathodic polarisation conditions. The magnitude of the effect suggests that proper attention should be given to this factor when conducting corrosion fatigue tests. Graphs. 9 ref.
- A.J. Griffiths (National Physical Laboratory (UK)) and R.B. Hutchings, A. Turnbull (National Physical Laboratory (UK)). *Scr. Metall. Mater.*, 1 Sept. 1993, 29, (5), 623-626, [in English]. ISSN 0956-716X.
- 96-0557 **Hydrogen Embrittlement of P-110 Couplings for Mating 180 mm (7 in.) Casing in Oilfield Production.** (Book). Several tin-plated, low-alloy steel couplings designed to connect sections of 180 mm (7 in.) diameter casing for application in a gas well fractured under normal operating conditions. The couplings were purchased to American Petroleum Institute (API) specifications for P-110 material. Chemical analysis and mechanical testing of the failed couplings showed that they had been manufactured to the API specification for Q-125, a more stringent specification than P-110, and met all requirements of the application. Fractographic examination showed that the point of initiation was an embrittled region ~ 25 mm (1 in.) from the end of the coupling. The source of the embrittlement was determined to be hydrogen charging during tin plating. Changes in the plating process were recommended. Photomicrographs.
- C.W. Petersen (Exxon Production Research) and J. Day (Exxon). ASM International, Member/Customer Service Center, Materials Park, OH 44073-0002, United States, 1994, 307-311, [in English].
- 96-0558 **Corrosion Behaviour of Low-Manganese Stainless Steels.** (Conference Paper). Electrochemical measurements have shown that low-Mn (~ 0.2% Mn) stainless steels with low ($\leq 1.2\%$ Mo) or no molybdenum exhibit a higher pitting resistance in neutral sodium chloride (0.005-2 M) than the analogous commercial steels containing 1.4 ~ 2% Mn and ~ 2.8% Mo, or the special laboratory heats of similar composition, but, with a high sulfur content, up to ~ 0.2%. Microscopic examinations, X-ray microprobe analysis and SAM investigations have revealed a correlation between pitting resistance of the steels, the composition of the non-metallic inclusions, and the composition of the passive film formed at the inclusions and at the adjacent matrix. Electrochemical measurements in acidic and neutral sulphates have shown that the low-Mn steels generally exhibit higher ability to passivate than the commercial ones. In contrast to the behavior in neutral solutions, also in those containing chlorides, the passivity of a modified steel containing neither Mo or titanium is less stable in acidic media than that of the other novel steels. Graphs. 24 ref.
- A. Szummer (Technical University of Warsaw) and M. Janik-Czachor (Polish Academy of Sciences). Advances in Corrosion and Protection [Proc. Conf.], Manchester, United Kingdom, 28 June-3 July 1992, *Corros. Sci.*, 1993, 35, (1-4), Pergamon Press Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, United States, 1993, (Met.A., 199408-72-0541) 317-327, [in English]. ISSN 0010-938X.
- 96-0559 **Degradation of High Performance Aero-Engine Turbine Blades.** (Conference Paper). Common forms of damage incurred by cast turbine blades in high performance aero engines are reviewed. While creep continues to play an important role in the degradation of blades in early generation engines, the life limiting mode of damage for blades in high performance engines is often leading edge thermal fatigue cracking occurring as a result of exposure to cyclic thermal loads during engine start-up and shut down. Apart from thermal fatigue, environmental damage due to oxidation and Type I hot corrosion may also occur during service. Thin wall cooled blade airfoils may suffer oxidation damage along uncoated surfaces of internal cooling passages, where the oxide penetration can reduce the load bearing cross-section of the airfoil. In high salt environments, Type I hot corrosion damage may occur at airfoil locations where service temperatures are of the order of $900^\circ C$. Exposure to overtemperature is another mode of degradation that may occasionally be incurred by turbine blades. Incipient melting, coating blistering and irreparable damage to the coating-substrate diffusion zone are characteristic of blades subjected to severe cases of overtemperature. The creep properties of the substrate material are influenced by overtemperature and, in particular, the tertiary creep behavior can be significantly altered. Photomicrographs. Graphs. 9 ref.
- A.K. Koul (National Research Council of Canada) and P.C. Patnaik (Hawker Siddeley Canada), R.V. Dainty, J.P. Immangeon (National Research Council of Canada). Advanced Materials and Coatings for Combustion Turbines [Proc. Conf.], Pittsburgh, Pennsylvania, United States, 17-21 Oct. 1993, ASM International, Member/Customer Service Center, Materials Park, OH 44073-0002, United States, 1994, (Met.A., 199408-72-0521) 69-74, [in English].
- 96-0560 **Pitting Corrosion of Stainless Steel by Potable Municipal Water in an Organic Chemical Plant.** (Book). Several tubes in a 35 m² (115 ft²) type 316 stainless steel shell-and-tube condenser leaked unexpectedly in an organic chemical plant that produces vinyl acetate monomer. Leaks were discovered after five years of operation and relocation of the condenser to another unit in the same plant. Examination of tubes and tube sheets revealed pitting damage on the OD surface. Some of the pits had penetrated fully, resulting in holes. Inside diameter surfaces were free of corrosion. Macro- and microexaminations indicated that the tubes had been properly manufactured. Pitting was attributed to stagnant water on the shell side. It was recommended that the surfaces not be kept in contact with closed stagnant water for appreciable lengths of time. 1 ref.
- K.E. Perumal (Corrosion and Metallurgical Consultancy Centre). ASM International, Member/Customer Service Center, Materials Park, OH 44073-0002, United States, 1994, 227-228, [in English].
- 96-0561 **A Study of the Protective Properties of a New Foaming Inhibitor During Sulfuric Acid Pickling of Rolled Metal Products.** [Previously titled: Testing of Protective Ability of a New Foam-Inhibitive Compound in Sulfuric Acid Etching of the Rolled Steel.] (Translation). Previously abstracted from original as item 9310-35-1798.
- R.A. Eremeeva (Dnepropetrovsk Metallurgical Institute) and V.G. Emel'yanov, N.A. Grebenyuk, V.F. Tolstikh (Dnepropetrovsk Metallurgical Institute). *Prot. Met. (Russia)*, Mar.-Apr. 1993, 29, (2), 253-254, [in English]. ISSN 0033-1732.
- 96-0562 **Fractographic Analysis: Sulfide Stress Cracking of Mild Steel Exposed to a Sour Gas Environment.** (Conference Paper). Sulfide stress cracking damage of mild steel in a complex brine solution containing a high concentration of hydrogen sulfide in conjunction with carbon dioxide was investigated. Slow strain rate tests using tensile specimens were conducted with respect to the interactive effect of the sour gas environment and the material including both crack initiation and propagation. Multiple cracks were found on the outside surface of some components, indicating typical anodic stress corrosion cracking. Fractographic analysis indicated that crack initiation as a result of H embrittlement was located at the enter of the component due to the enhanced triaxial stress condition. Slow strain rates (1×10^{-4} to 5×10^{-6} s) resulted in outside surface cracks indicating a dominance of the stress corrosion cracking mechanism. However very slow strain rates ($< 10^{-7}$ s) changed the crack initiation to the center of the component and resulted in nearly 100% brittle failure. Similarly the occurrence of crack initiation shifted to the center of the component when there was an absence of carbon dioxide in the environment, which was representative of a H embrittlement mechanism. Graphs, Photomicrographs. 14 ref.
- H. Huang (University of Calgary) and W.J.D. Shaw (University of Calgary). Structure-Property Relationships and Correlations With the Environmental Degradation of Engineering Materials [Proc. Conf.], Monterey, California, United States, 31 July-1 Aug. 1991, ASM International, Member/Customer Service Center, Materials Park, OH 44073-0002, United States, 1992, (Met.A., 199408-72-0540) 265-275, [in English].

96-0563 Hydrogenation and corrosion of high-strength steel in acid solutions. The effect of sulfuric and hydrochloric acids on the hydrogenation of 40KhGSN3BA is found to be different. Chloride ions promote corrosion but as the steel is saturated by hydrogen the process becomes less intensive. Sulfuric acid has lower effect on the hydrogenation due to the formation of difficultly soluble corrosion products on the surface of specimens. The findings make it possible to make the best choice of pickling variables for high-tensile steels and to improve the quality of electrodeposits and lacquer deposits applied upon pickling. Graphs. 5 ref.

Yu.A. Bashnin, S.S. Ivanov (Moscow Night Metallurgical Institute). *Stal'*, Feb. 1995, 2, 60-61, [in Russian]. ISSN 0038-920X.

96-0564 Investigation of corrosion-resistance of SW-206 austenitic stainless steel with high molybdenum and ultra low carbon content. The excellent corrosion-resistant property of SW-206 austenitic stainless steel with high Mo and ultra low C content was described, as well as the corrosion test and its application in main corrosion medium of petrochemical and chemical fiber industry such as acetic acid, acetal agent and seawater. Graphs. 12 ref.

X. Wu (Mechanical Research Institute of Shanghai Petrochemical) and Z. Sun (Mechanical Research Institute of Shanghai Petrochemical), T. Qu (Shanghai Iron and Steel Institute). *Shanghai Jinshu (Shanghai Met.)*, July 1995, 17, (4), 20-26, [in Japanese]. ISSN 1001-7208.

96-0565 Effect of structure, chemical and phase composition on electrochemical and corrosion properties of high-chromium iron-chromium-aluminum alloys. Electrochemical and corrosion properties of high chromium Kh27Yu5, Kh40Yu2, Kh45Yu4 and Kh60Yu2 alloys in solution of 0.5 M sulfuric acid are studied. An influence of structure, chemical and phase compositions on the anodic characteristics of alloys is established. It is shown that the corrosion-electrochemical behaviour improves in process of alloy wear testing in contact with a polymeric mass. The fact is explained that oxygen, blocking chromium atoms and inhibiting its transition in solution, is penetrated in a deformed surface layers originating under friction. Photomicrographs, Graphs, Numerical Data, Spectra. 14 ref.

S.V. Dan'ko, N.P. Korzhova, E.Yu. Shestakova, N.V. Vyazovikina (Academy of Sciences of Ukraine). *Zashch. Met.*, Jan.-Feb. 1995, 31, (1), 31-37, [in Russian]. ISSN 0044-1856.

96-0566 Proof by UV-visible modulated reflectance spectroscopy of the breakdown by carbonation of the passivating layer on iron in alkaline solution. Carbonation of concrete by atmospheric CO₂ may lead to breakdown of the passivating layer of the steel reinforcements, leading to catastrophic corrosion, if the pH of the electrolyte in the concrete pores decreases below 8. The nature of this carbonation process has been studied by means of potential-modulated reflectance (PMR) spectroscopy, followed the changes in the PMR spectrum of air-passivated iron in 1M NaOH produced by sparging the electrolyte with a CO₂+air mixture. Decreasing the pH from 8.02-7.69 produced the disappearance of the Fe₂O₃ PMR signal and nearly a doubling of the PMR maximum of FeOOH, point in to a hydration of Fe₂O₃ to FeOOH preceding the breakdown of the passivating layer. A further decrease of only 0.07 pH units, down to pH 7.62, effected an increase of the corrosion rate of nearly two orders of magnitude and the disappearance of the PMR spectrum of the passivating layer, this being the first spectroscopic proof that depassivation by carbonation is due to a complete electrochemical dissolution of the passivating layer. Spectra, Graphs. 15 ref.

M.A. Climent (CSIC) and C. Gutiérrez (CSIC). *Surf. Sci.*, 1995, 330, (1), L651-L656, [in English]. ISSN 0039-6028.

96-0567 Corrosion of pipeline steel and trunk lines under different soil-climatic conditions. The field investigations of free underground corrosion were performed for S13 and 17G1S pipeline steels depending on the soil type and temperature. It is shown that the dominant factor of soil corrosiveness is its average temperature with consideration for the heat contribution from structure under operation, what enhances sharply the hazard in the local corrosion. The corrosion correlation is not established neither with specific conductivity nor with salineness of the soil. Numerical Data, Graphs, Maps. 13 ref.

A.F. Marchenko. *Zashch. Met.*, Mar.-Apr. 1995, 31, (2), 161-169, [in Russian]. ISSN 0044-1856.

96-0568 Corrosion resistance of high strength low alloy steels in oil field media. The results of laboratory investigations and field tests are presented for 20KhG2RkBa and 32G2 low alloy steels in the oil wells. The pump-compressor tubes were tested under stratal or sea water conditions. The potentiostatic curves are plotted for the free and prestressed steel specimens. It is found that the high-temperature thermomechanically treated steels under study are an improved resistance to continuous and pitting corrosion as well as corrosion cracking in sea and hydrosulfuric-containing stratal water. Graphs, Numerical Data. 7 ref.

A.G. Aliev, A.G. Khanlarova, Ya.M. Nagieva, S.A. Ragimova (Gipromorneftegaz (Baku)). *Zashch. Met.*, Mar.-Apr. 1995, 31, (2), 170-174, [in Russian]. ISSN 0044-1856.

96-0569 A simulation of the behaviour of multi-surface fatigue cracks in type 304 stainless steel plate. Fatigue tests were carried out to study the growth and coalescence behavior of multi-surface cracks which were initiated at semi-circular surface notches, and an existing crack growth simulation program was developed to predict and compare with the experimental results. Additional comparison with ASME and BS1 conditions were also carried out to enhance the reliance and integrity of structures and machine elements. The results presented in this paper show that the simulation procedure has utility for fatigue life prediction. Graphs, Photomicrographs. 20 ref.

N.S. Hwang (Graduate School of Kyungpook National University), K.B. Yoon (Korea Research Institute of Standards and Science), C.M. Suh (Kyungpook National University). *Fatigue Fract. Eng. Mater. Struct.*, Apr. 1995, 18, (4), 515-525, [in English]. ISSN 8756-758X.

Non-ferrous metals/Nichteisenmetalle

96-0570 The Tarnishing of Silver and Ag-Au Alloys in Aqueous Sulfide Solutions and in H₂S Atmospheres. (Conference Paper). The tarnishing kinetics of Ag and AgAu alloys (model alloys for electrical contact materials) is studied at room temperature in aqueous sulfide solutions (2M NaOH + xNa₂S; 0.5 mM < x < 10 mM) and the results compared to those of the tarnishing in 1 ppm H₂S atmospheres and controlled relative humidity (70, 80 and 90% RH). For Ag-Au alloys tarnishing proceeds in both media by formation of Ag₂S, Ag₃As₂S₃ and Ag₂S. The electrochemical behavior of sulfides on Ag-Au alloys is light sensitive. On Ag only Ag₂S is formed and no photo effect is observed. In H₂S-atmospheres the rate of formed Ag-Au-sulfides to Ag₂S increases with the time of exposure, H₂O-activity and gold concentration of the alloy. Graphs. 9 ref.

L.F.P. Dick (Universidade Federal do Rio Grande do Sul) and H. Kaesche, H. Kaiser (Universität Erlangen-Nürnberg). Corrosion and Reliability of Electronic Materials and Devices [Proc. Conf.], Toronto, Canada, 11-16 Oct. 1992, PV 93-1, The Electrochemical Society, Inc., 10 South Main St., Pennington, New Jersey 08534-2896, United States, 1993, (Met.A., 199408-72-0523) 406-414, [in English]. ISBN 1-56677-051-3.

96-0571 The Effects of Dilution Upon the Corrosion and Wear Properties of Co-Cr-Based Weld Overlays. (Conference Paper). The use of weld overlays to protect critical surfaces from corrosion and wear is well established. In applying such deposits, however, intermixing with the substrate (dilution) is inevitable. Although it is generally accepted that dilution degrades the performance of the overlay, quantitative information is scarce. The purpose of this study was to generate such information. To overcome the issues of compositional homogeneity and one-sided corrosion tests, the overlay material (UNS R31233, a Co-based alloy) was premixed with quantities of UNS G10400 carbon steel and UNS S31603 stainless steel, and standard corrosion and wear samples prepared from all-weld-metal blocks. Significant changes in corrosion and wear behaviour were recorded. 7 ref.

P. Crook (Haynes International). Advances in Corrosion and Protection [Proc. Conf.], Manchester, United Kingdom, 28 June-3 July 1992, *Corros. Sci.*, 1993, 35, (1-4), Pergamon Press Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, United States, 1993, (Met.A., 199408-72-0541) 647-653, [in English]. ISSN 0010-938X.

96-0572 Estimates of trapping of hydrogen at dislocations in palladium: suggestions for future sans experiments. Calculations have been performed to estimate the number of hydrogen atoms trapped at the dislocation core and the strain field surrounding it as a function of bulk concentration of hydrogen in palladium. The results of the calculations have been compared with small angle neutron scattering (SANS) results in Pd containing 5500 appm bulk hydrogen concentration. SANS measurements showed 2.6 hydrogen atoms/Å of dislocation line compared to 1.21 Å in the strain field of dislocation. This difference could be attributed to hydrogen trapped in the core region or hydrogen-hydrogen interaction. It is shown that relative distribution of hydrogen atoms between dislocation core and strain field depends on the binding energy between the defect and hydrogen atom. At low bulk concentration, a dramatic difference in core hydrogen concentration exist between two binding energies. At low temperatures the core hydrogen concentration is independent of binding energy. It is suggested that SANS measurements at low concentrations of hydrogen could provide more information such as number of sites and core radius. Graphs. 8 ref.

Scr. Metall. Mater., 15 May 1995, 32, (10), 1619-1624, [in English]. ISSN 0956-716X.

96-0573 In situ HREM observations of the oxidation of nickel thin foils. (Conference Paper). Growth of oxide microcrystals at the edge of nickel grains could be observed using high-resolution microscopy. Three types of samples were examined: a Ni-cermet material, and pure annealed Ni, both ion-beam milled; and a standard electropolished Ni foil. Microstructural features, such as crystallite size, facets, orientation relationship and lattice parameter are described. Photomicrographs. 7 ref.

L. Thien-Nga (University of Oxford) and B. Derby, J.L. Hutchison. Structure and Properties of Interfaces in Ceramics [Proc. Conf.], Boston, Massachusetts, USA, 28 Nov.-2 Dec. 1994, Materials Research Society, 9800 McKnight Rd., Suite 327, Pittsburgh, PA 15237, USA, 1995, (Met.A., 199510-72-0375) 225-229, [in English]. ISBN 1-55899-258-8.

96-0574 Structure of oxides grown on Zr-20Nb alloy. (Conference Paper). Oxides grown on Zr-20Nb were characterized by Raman spectroscopy (RS), x-ray diffraction (XRD) and transmission electron microscopy (TEM). These oxides were steam-formed at 400°C, water-formed at 360°C and at 300°C, and air-grown at 400°C. For the oxides grown after relatively short exposures at 360°C and at 400°C, Raman spectra revealed broad peak at 260 and 660 cm⁻¹ indicating a crystal structure with high symmetry. Comparison with reference Raman spectra of cubic (c), tetragonal (t), and monoclinic (m) ZrO₂ suggested that the oxide was predominantly nearly-cubic (tetragonal with c/a ratio ≈ 1), with minor amounts of m-oxide. The tetragonality is found to be consistent with TEM analyses and XRD results which showed the presence of a doublet near 2θ=74°. The crystal structure in the short-term exposed oxides is interpreted in terms of a tetragonal distortion arising from the displacement of oxygen atoms within the cubic ZrO₂ crystal structure. For oxides grown after longer periods of exposure at 300°C and at 400°C, RS and XRD indicate increased amounts of m-oxide. Spectra, Photomicrographs, Diffraction Patterns. 3 ref.

O.T. Woo (AECL Research) and V.F. Urbanic (AECL Research), D.J. Lockwood (National Research Council of Canada), Y.P. Lin (Ontario Hydro). Structure and Properties of Interfaces in Ceramics [Proc. Conf.], Boston, Massachusetts, USA, 28 Nov.-2 Dec. 1994, Materials Research Society, 9800 McKnight Rd., Suite 327, Pittsburgh, PA 15237, USA, 1995, (Met.A., 199510-72-0375) 219-224, [in English]. ISBN 1-55899-258-8.