

# Table of Contents

## Foreword

<b>Mathematical Modelling of Alloy Oxidation</b>	
F. Gesmundo	3
<b>The Oxidation of Alumina-Forming Alloys</b>	
F.H. Stott	19
<b>High Temperature Oxidation of Single-Crystal Ni-Base Superalloys</b>	
K. Bouhanek, D. Oquab and B. Pieraggi	33
<b>High Temperature Oxidation of Fe-Cr-Al Alloys Containing Reactive Elements</b>	
J. Deakin, V. Prunier, G.C. Wood and F.H. Stott	41
<b>Oxidation à Haute Température de Poudres d'Alliages MCrAlY (M=Co, Ni) à Différentes Teneurs en Aluminium</b>	
B. Rhouta, M. Hajjaji, D. Oquab and B. Pieraggi	49
<b>Isothermal and Cyclic Oxidation of Chromia Forming Nickel-Based Superalloys</b>	
J.H. Chen, P.M. Rogers and J.A. Little	57
<b>On the Oxygen Pressure Dependence of High Temperature Oxidation of Copper</b>	
R. Haugsrud and P. Kofstad	65
<b>The Air Oxidation of a Cr-5wt% Ag Alloy at 650-750°C</b>	
Y. Niu, A.M. Huntz, F. Gesmundo and P. Castello	73
<b>SFT Formation and Its Effect on Internal Oxidation of AgCu</b>	
X. Peng, T.F. Li and W.T. Wu	81
<b>Relation entre la Présence d'Eléments d'Alliage et les Mécanismes de Croissance de la Couche d'Oxydes Formée sur Aciers Ferritiques AISI 430. Influence de Mn, Al et Ti</b>	
C. Berthier, J.M. Lameille, M. Lenglet, R. Hamacha, J. Lopitaux and E. Beucher	89
<b>The Corrosion of Fe-15wt% Y and Pure Y and Fe in H<sub>2</sub>-H<sub>2</sub>S Mixtures under 10<sup>-8</sup> atm S<sub>2</sub> at 600-800°C</b>	
Y. Niu, F. Gesmundo, C. Zeng, W.T. Wu, F. Viani and F.C. Rizzo	97
<b>A Comparison of High-Temperature Corrosion between Cu/Ni Multilayers and Cu-Ni Alloys with the same Composition</b>	
A.-. Daltin, C. Bertrand, J. Douglade and S. Toesca	105
<b>Interfacial Reactions and Diffusion during the Thermal Oxidation of Titanium in Water Vapour</b>	
A. Galerie, Y. Wouters and J.P. Petit	113
<b>High Temperature Oxidation of Nb-Ti-Al Alloys</b>	
C. Roos, D. Oquab and B. Pieraggi	119
<b>The Chemistry of Sulfidation Corrosion-Revisited</b>	
N.S. Bornstein and W.P. Allen	127
<b>The Nonstoichiometry and Chemical Diffusivity of Iron-Chromium Sulfide (Fe,Cr)<sub>1-δ</sub>S</b>	
M. Noguchi, T. Yamamoto and T. Narita	135
<b>Presentation of an Atlas of Chemical and Electrochemical Equilibria in the Precence of a Gaseous Phase</b>	
M. Pourbaix, H. Zhang and A. Pourbaix	143
<b>Oxidation of Aluminides</b>	
H.J. Grabke	149
<b>Influence of Palladium on Diffusion Processes in the B2 NiAl Phase</b>	
P. Lamesle, P. Steinmetz, M. Vilasi and J.M. Claude	163
<b>Effect of Palladium and Chromium Additions on the Oxidation Behaviour of β-NiAl Alloys</b>	
P. Lamesle, M. Vilasi, J.M. Claude and P. Steinmetz	171
<b>Isothermal Oxidation of P/M-TiAl Alloys</b>	
M. Hald and M. Schütze	179
<b>A New Phase in the Ti-Al-O System: Its Significance for TiAl Oxidation</b>	
W.J. Quadakkers, N. Zheng, A. Gil, E. Wallura and H. Hoven	187
<b>High-Temperature Oxidation Life Characteristics of ODS-Fe<sub>3</sub>Al</b>	
I.G. Wright, B.A. Pint, C.S. Simpson and P.F. Tortorelli	195

<b>High Temperature Oxidation Behaviour of Ti<sub>3</sub>Al-Nb Intermetallics</b>	203
S.K. Jha, A.S. Khanna and C.S. Harendranath	
<b>TEM Investigations Concerning the Effect of Nitrogen on the Oxidation of TiAl</b>	211
F. Dettenwanger, E. Schumann, J. Rakowski, G.H. Meier and M. Rühle	
<b>High Temperature Corrosion Behaviour of Ti-46.6Al-1.4Mn-2Mo in Environments of Low Oxygen and High Sulphur Potentials at 750 and 900°C</b>	219
H.L. Du, P.K. Datta and S.K. Hwang	
<b>Oxidation Behaviour of Ti<sub>5</sub>Si<sub>3</sub> at Temperatures between 1400 and 1700 K</b>	227
S. Taniguchi, T. Minamida and T. Shibata	
<b>Use of a Free-Jet Expansion, Molecular Beam Mass Spectrometer to Understand Processes Involving Volatile Corrosion Products</b>	235
N.S. Jacobson	
<b>Effect of Silicon on the Protective Character of Cr<sub>2</sub>O<sub>3</sub> Scales: Analyses by "In Situ" XPS</b>	243
A.M. Huntz, M.K. Loudjani, C. Séverac, C. Haut and F. Ropital	
<b>High Temperature Oxidation of Fe-Al Alloys Studied by In Situ X-Ray Diffraction</b>	251
V. Kolarik, H. Fietzek, W. Engel, B. Eltester and H.J. Grabke	
<b>The Use of Ion Implantation to Study the Influence of Yttrium on the Oxidation Behaviour of PM Chromium</b>	259
M.F. Stroosnijder, M.J. Cristóbal and J.D. Sunderkötter	
<b>FTIR Study of the Influence of Minor Alloying Elements on the High Temperature Oxidation of Nickel Alloys</b>	267
M. Lenglet, F. Delaunay and B. Lefez	
<b>The Use of Thin Layer Activation in Cyclic High Temperature Corrosion Studies</b>	275
M.F. Stroosnijder, V.A.C. Haanappel and I. Murris	
<b>High Temperature Oxidation Behaviour of Laser Alloyed Ferritic Steels</b>	283
A. Küller, A.S. Khanna, A. Gasser and C.S. Harendranath	
<b>Thermal Oxidation Resistant Surface Alloys Processed by Laser Alloying on Z38CDV5 Ferritic Steel</b>	291
E. Gemelli, A. Galerie and M. Caillet	
<b>Fundamental Aspects of Reactions at the Metal/Scale Interface During Scaling</b>	299
B. Pieraggi	
<b>Atomic Transport in Cr<sub>2</sub>O<sub>3</sub> and Al<sub>2</sub>O<sub>3</sub> Scales: Growth Mechanism and Effect of Yttrium</b>	313
A.M. Huntz, S.C. Tsai, J. Balmain, K. Messaoudi, B. Lesage and C. Dolin	
<b>The Stress State in Thermally Grown NiO Scales</b>	325
P.Y. Hou and R.M. Cannon	
<b>Determination of Stress Gradients in a Thermally Grown Oxide Layer Using X-Ray Diffraction</b>	333
D. Zhu, J.H. Stout and D.A. Shores	
<b>The Effects of Stress on the Internal Oxidation of Ni-Cr and Ni-Al Alloys</b>	341
L. Bradley, G.C. Wood and F.H. Stott	
<b>Stresses in Thin Fe Cr Al Foils Related to Oxidation</b>	349
J.M. Herbelin and M. Mantel	
<b>High Temperature Oxidation of Thin FeCrAl Strips</b>	357
E. Andrieu, A. Germidis and R. Molins	
<b>Spallation of Oxide Scales from NiCrAlY Overlay Coatings</b>	365
A. Strawbridge, H.E. Evans and C.B. Ponton	
<b>Local Analysis of the Stress Development in Alumina Scales on NiAl and FeCrAl</b>	373
M. Hollatz, M. Bobeth and W. Pompe	
<b>Stresses in Cr<sub>2</sub>O<sub>3</sub> Scales Developed on Ni-30Cr</b>	381
S. Daghighi, J.L. Lebrun and A.M. Huntz	
<b>The Effect of Yttrium and Sulfur on the Oxidation of FeCrAl</b>	389
C. Mennicke, E. Schumann, C. Ulrich and M. Rühle	
<b>Study of the Reactive Element Effect in ODS Iron-Base Alumina Formers</b>	397
B.A. Pint	
<b>The Effects of Reactive Element Additions, Sulfur Removal, and Specimen Thickness on the Oxidation Behaviour of Alumina-Forming Ni-and Fe-Base Alloys</b>	405
S. Sarioglu, J.R. Blachere, F.S. Pettit, G.H. Meier, J.L. Smialek and C. Mennicke	

<b>Effect of Impurities (Carbon and Manganese) on Iron Oxidation at High Temperature: Impurities-Rare Earth Element (Cerium) Interactions</b>	413
C. County, H. Buscail and J.P. Larpin	
<b>High Temperature Corrosion Behaviour of Coated F17Ti Stainless Steel</b>	419
M. Silva, S. Chevalier, G. Bonnet and J.C. Colson	
<b>Sol-Gel Methods for the Application of Reactive Elements on Iron-Based Alloys</b>	429
C.R. Simon, M. Seiersten and P. Caron	
<b>The Influence of Yttrium on the Interfacial Fracture Resistance in Oxide Film/Ni-25Cr Alloy Systems</b>	437
D. Zhu, J.H. Stout, J.C. Nelson and D.A. Shores	
<b>Nickel Based Alloy Intergranular Embrittlement in Relation with Oxidation Mechanisms</b>	445
R. Molins, J.C. Chassaigne and E. Andrieu	
<b>Contraintes de Croissance dans l'Alumine au Cours de l'Oxydation à 1300°C d'un Alliage Ferritique</b>	453
B. Dionnet, F. Clemendot, F. Sibieude and F. Nardou	
<b>Effect of the Ordering of Metal/Oxide Interface on the Thermomechanical Behaviour of High Temperature Oxidized Metal Films</b>	459
L. Lahoche, V. Lorman, S.B. Rochal and J.M. Roelandt	
<b>Investigation into the High Temperature Wear Properties of Alloys Contacting against Different Counterfaces</b>	467
P.D. Wood, P.K. Datta, J.S. Burnell-Gray and N. Wood	
<b>The Behaviour of Oxide Scales on Metals Under Erosion-Corrosion at High Temperature</b>	475
N. Birks, F.S. Pettit and B. Peterson	
<b>Some Practical Aspects of Corrosion and Coatings in Utility Gas Turbines</b>	483
H.W. Grünling, H. Rechtenbacher and L. Singheiser	
<b>Corrosion of Metallic Materials in Waste Incinerators</b>	505
P. Steinmetz and C. Rapin	
<b>High Temperature Corrosion in Waste Incinerators Due to Deposits of Molten Chlorides</b>	519
E. Otero, A. Pardo, F.J. Pérez, T.P. Levi, M.V. Utrilla, M.L. Casado and M.C. Merino	
<b>Corrosion of High Alloy Steels and Fe-Cr-Alloys Beneath Deposits from Waste Incinerator Plants</b>	527
M. Spiegel, C. Schroer and H.J. Grabke	
<b>The Effect of Chemical Composition of Ash Deposit on the Corrosion of Boiler Tubes in Waste Incinerators</b>	535
K. Nakagawa and Y. Matsunaga	
<b>Materials Issues in Coal-Fired Combined Cycle Power Generation Systems: Laboratory versus Plant Testing</b>	543
N.J. Simms and J.E. Oakey	
<b>Limiting Factors for Fe-Cr-Al and NiCr in Controlled Industrial Atmospheres</b>	551
B. Jönsson and C. Svedberg	
<b>The Effect of Pre-Oxidation with Ceria on the Carburisation of Incoloy 800HT</b>	559
M. Seiersten, C.R. Simon and K. Osvold	
<b>High Temperature Reaction of Chromium with Multi-Oxidant Atmospheres</b>	567
X.G. Zheng and D.J. Young	
<b>The Effect of Chlorine on Mixed Oxidation/Sulfidation of Stainless Steels Below 600°C</b>	575
W.T. Bakker	
<b>Behaviour of FeCrAlloy and Iron Aluminides Alloys in Coal Gasification Atmospheres Containing HCl</b>	583
S.R.J. Saunders, D.D. Gohil, J.P. Banks, M.U. Sheriff, P.F. Tortorelli, J.H. De Van and I.G. Wright	
<b>Corrosion Behaviour of some Fe-Base Alloys in H<sub>2</sub>-H<sub>2</sub>O and H<sub>2</sub>-H<sub>2</sub>O-HCl Gas Mixtures at 973 K</b>	591
B. Önay, T. Morimoto and S. Nakamura	
<b>Ageing Processes of Automotive 3-Way Catalyst Materials at High Temperatures in Sulphur-Bearing Oxidising Gases</b>	599
W.J. Quadakkers, R.J. Fordham and J.F. Norton	
<b>The Influence of Si Content upon the Corrosion Resistance of Fe-12%Cr and Fe-12%Cr-12%Ni Alloys Exposed in a Reducing/Sulphidising Atmosphere at 450°C</b>	607
J.F. Norton, M. Maier and W.T. Bakker	

<b>Corrosion of Several Steels after their Exposure at High Temperature to Oxygen and Sulfur Mixtures</b>	615
E. Otero, A. Pardo, F.J. Pérez, F.J. Perosanz, A. Parra and T.P. Levi	
<b>High Temperature Sulfidation of Al-and Mo-Modified 310 Stainless Steel</b>	625
W. Kai, C.T. Leu, J.P. Chu and P.Y. Lee	
<b>Hot Corrosion and its Prevention in High Temperature Heavy Oil Firing Gas Turbines</b>	633
M. Nakamori, I. Kayano, Y. Tsukuda, K. Takahashi and T. Torigoe	
<b>Mechanisms of Hot Corrosion in Coal Fired Boilers Gas T91 and EM12 Steels</b>	641
D. Colot, D. Petelot, P. Hoch and G. Béranger	
<b>Hot Salt Stress Corrosion Cracking and Corrosion Fatigue of Titanium Alloys</b>	649
M. Cash and J.R. Nicholls	
<b>Influence of Temperature, Sulphur Dioxide and Thermal Exchange on Deposit Induced Oxidation/Sulphidation of Alloys for Fluidized Bed Combustors</b>	657
F. Uberti, A. Colombo, G.P. De Gaudenzi and G. Rocchini	
<b>Metal Dusting of Stainless Steels</b>	665
D. Monceau, E.M. Müller-Lorenz and H.J. Grabke	
<b>Etude des Interactions Métaux Liquides-Matériaux</b>	671
J. Daviot and V. Grabon	
<b>Corrosion of Immersed Ceramic Heat Exchanger Tubes in Aluminium Foundry Baths</b>	679
C.B. Bracho-Troconis, N. Frety, G. Frot, Y. Bienvenu and I. Alliat	
<b>Behaviour of Thermally Sprayed Ceramic Coatings on Steel Structures in Molten Aluminium Baths</b>	685
C. Coddet, J. Kind and B. Normand	
<b>Interaction of Liquid Zinc with Non-Metallic Coatings on Steel</b>	693
P. Liberski, P. Podolski, A. Gierek and B. Formanek	
<b>Stability of Oxide Films on Liquid Metals under Vacuum: Influence on Wetting of Metals on Ceramic Surfaces</b>	701
C. Chatillon, L. Coudurier and N. Eustathopoulos	
<b>Corrosion of Nickel-Chromium Alloys by Molten Glass at 1100°C: An Electrochemical Study</b>	709
D. Lizarazu, P. Steinmetz and J.L. Bernard	
<b>The Formation and Oxidation Resistance of Boron-Modified and Germanium-Doped Silicide Diffusion Coatings for Titanium and Molybdenum</b>	723
B.V. Cockeram and R.A. Rapp	
<b>Mechanical and Chemical Characterisation of Coated Systems</b>	737
S. Osgerby, S.R.J. Saunders, D.D. Gohil and G. Shafirstein	
<b>Influence d'un Revêtement de Silice sur la Réactivité d'un Alliage FeCrAl</b>	745
R. Hamacha, D. Merle and F. Nardou	
<b>The Deposition and Oxidation Resistance of Aluminide Coatings on <math>\gamma</math>-TiAl</b>	753
T.C. Munro and B. Gleeson	
<b>High Temperature Oxidation Resistant Coatings on Molybdenum</b>	761
H.P. Martinz and M. Rieger	
<b>Oxidation and Protection of Near-Alpha Titanium Alloys</b>	769
C. Leyens, M. Peters and W.A. Kaysser	
<b>Surface Coatings on Titanium Alloys to Limit Oxygen Ingress</b>	777
M.J. Deakin and J.R. Nicholls	
<b>Transient Oxidation of Al-Deposited Fe-Cr-Al Alloy Foil</b>	785
A. Andoh, S. Taniguchi and T. Shibata	
<b>MeCrAl Coatings Obtained by Arc PVD and Pack Cementation Processes on Nickel Base Superalloys</b>	793
L. Swadźba, A. Maciejny, B. Formanek and B. Mendala	
<b>The Oxidative and Corrosive Degradation of Vacuum Plasma Sprayed Coatings in Industrial Gas Turbine Environments</b>	801
D.J. Baxter, D. Gilliland, F. Lanza, G.P. Toledo and F. Bregani	
<b>An Assessment of Thermal Spray Coating Technologies for High Temperature Corrosion Protection</b>	809
G.R. Heath, P. Heimgartner, G. Irons, R.D. Miller and S. Gustafsson	

<b>Oxidation and Corrosion of Silicon-Based Ceramics and Composites*</b> N.S. Jacobson, E.J. Opila, D.S. Fox and J.L. Smialek	817
<b>The Corrosion of Ceramic-Matrix Composites*</b> P. Colomban	833
<b>Oxidation and Corrosion Mechanisms for Silicon Nitride - Based Ceramics in Air and Fused Salts</b> P. Byrne, R. Ramesh and M.J. Pomeroy	845
<b>Oxidation Kinetics of Silicon Nitride Ceramics: Influences of the Crystallisation and Additive Enrichment in the Oxide Scale</b> J.M. Chen, M. Heim and R. Pompe	853
<b>Oxidation and Reduction of Ceramic Composites</b> D.W. Readey	861
<b>Oxidation Resistance in Air of 1-D SiC (Hi-Nicalon) Fibre Reinforced Silicon Nitride Ceramic Matrix Composite</b> P. Dupel and J.-. Veyret	869
<b>An Oxidation of the Sintered <math>\text{Si}_3\text{N}_4 + 1,5\% \text{MgO}</math> in Water Vapour at Temperatures 1073 - 1273 K</b> Z. Żurek, J. Jedlinski, A. Gil and G. Borchardt	877
<b>High Temperature Oxidation of <math>\text{MoSi}_2\text{-WSi}_2</math>Solid Solutions</b> K. Kurokawa, H. Matsuoka and H. Takahashi	885
<b>Oxidation Kinetics of <math>\text{MgO}\text{-SiC}</math> Composites</b> M.E.F. Camey, D.J. Aldrich and D.W. Readey	893
<b>Comparison of the Oxidation Behaviour of Three Dense Hiped Materials: Titanium Nitride, Aluminium Nitride Materials and a 50-50 mol.% <math>\text{AlN-TiN}</math> Composite</b> M. Desmaison-Brut, L. Bianchi, S.V. Schneider, L. Themelin and J. Desmaison	901
<b>High Temperature Oxidation Behaviour of Mullite Coated C/C Composites in Air</b> H. Fritze, A. Lenk, T. Witke, S. Weber, S. Scherrer, R. Weiss, B. Schultrich and G. Borchardt	909
<b>Oxidation of <math>\text{Al}_2\text{O}_3\text{-Cu}</math> Composites</b> S. Larpkiattaworn and D.W. Readey	917
<b>Interaction between Two Ni-Base Alloys and Oxide Ceramics: <math>\text{SiO}_2</math>, <math>\text{ZrO}_2</math>, <math>\text{HfO}_2</math>, <math>\text{Al}_2\text{O}_3</math></b> X.Y. Virieux, J. Desmaison, J.C. Labbe and A. Gabriel	925
<b>Erosion and Foreign Object Damage of Thermal Barrier Coatings</b> J.R. Nicholls, Y. Jaslier and D.S. Rickerby	935
<b>Thermophysical Properties of Ceramic Layers in TBC-EB</b> Y.A. Tamarin, E.B. Kachanov and S.V. Zherzdev	949
<b>Thermocyclic Behaviour of Microstructurally Modified EB-PVD Thermal Barrier Coatings</b> U. Schulz, K. Fritscher, H.-. Rätzer-Scheibe, W.A. Kaysser and M. Peters	957
<b>TEM Investigation on the Adhesion of YPSZ EB-PVD TBCs</b> K. Fritscher, M. Schmücker, C. Leyens and U. Schulz	965
<b>A Code of Practice for Discontinuous Corrosion Testing in High Temperature Gaseous Atmospheres</b> D.B. Meadowcroft, A.B. Tomkings, H.J. Grabke, S. Hertzman, R. Johansson, B. Jonsson, J. Lindén, J. Klöwer, J. Nicholls, J.F. Norton, G. Rocchini and S.R.J. Saunders	973
<b>A New Architecture for a Factual Materials Database on Coatings and High Temperature Corrosion</b> R. Streiff, S. Komornicki, S. Vaugelade and D.H. Boone	979
<b>Data Management with the Corrosion Databank</b> G.F. Casula, H.H. Over and D.J. Baxter	989