

# Table of Contents

## Preface

## National Scientific Committee

## In Memoriam

## International Scientific Committee

## Plenary

### **Void Formation in the Growing Scale Induced by the Divergence of the Diffusive Ionic Flux in High Temperature Oxidation of Metals**

T. Maruyama, M. Ueda and K. Kawamura 1

### **Diffusion in Metallic Elements and Intermetallics**

H. Mehrer and S.V. Divinski 15

## Chapter I Diffusion and Alloys

### **Selected Observations in Phase Constituents, Growth Kinetics and Microstructural**

### **Development of Aluminides in U-Mo vs. Al and 6061 Diffusion Couples Annealed at 600°C**

E. Perez, D.D. Keiser and Y.H. Sohn 41

### **Diffusion in Metal Dusting Processes**

D.J. Young, M.A.A. Motin and J. Zhang 51

### **Isotope Fractionation due to Sedimentation of Atoms in Centrifuged Indium-Lead Alloy**

M. Ono, Y. Iguchi, S. Okayasu, F. Esaka, K. Kobayashi, T. Hao, R. Bagum, T. Osawa, K. Fujii, E. Nakamura and T. Mashimo 63

### **Effect of a Low-Concentration H<sub>3</sub>PO<sub>4</sub> Solution Application on High-Temperature**

### **Behaviour of Ti and Ti-Al Alloys**

S.Y. Brou, G. Bonnet and J.L. Grosseau-Poussard 69

### **Structural Investigations of Solidification and Heat Treatments Influence on High Alloyed Cast Irons Grades with Nb-V-Ti Additions**

J. Lecomte-Beckers and J. Tchoufang Tchuindjang 77

### **Influence of Beta Stability on Hydrogen Diffusion in Various Beta Titanium Alloys**

H.J. Christ and P. Schmidt 87

### **Grain Boundary Diffusion of Ni in Ultra-Fine Grain Copper-Lead Alloy Produced by Equal Channel Angular Pressing**

J. Ribbe, G. Schmitz, Y. Estrin and S.V. Divinski 95

### **Verification of a Commercial CALPHAD Database for Re and Ru Containing Nickel-Base Superalloys**

R. Rettig, A. Heckl, S. Neumeier, F. Pyczak, M. Göken and R.F. Singer 101

### **The Effect of Austenite Grain Size on the Growth of Different Ferrite Morphologies in a Nb-Microalloyed Steel**

M. Esmailian 109

### **Surface Alloying of AISI H13 Steel during Electrical Discharge Machining (EDM)**

G.P. Rodriguez, J. Simao and G. Herranz 119

### **Thermal Stability and Creep Behaviour of MgNiYCe-Rich Mischmetal Alloys Processed by a Powder Metallurgy Route**

P. Pérez, K. Milicka, J.M. Badía, G. Garcés, J.M. Antoranz, S. González, F. Dobes and P. Adeva 127

### **A Methodology to Deduce the Microstructural Spatial Deformation of Polycrystalline Structures: Application to the Alloy 600**

A. Clair, M. Foucault, J.M. Salazar, V. Vignal, E. Finot and L. Markey 137

### **Diffusion of <sup>65</sup>Zn in AZ91 and QE22 Alloys with Saffil Reinforcement-Influence of Interfaces Matrix/Saffil**

I. Stloukal and J. Čermák 145

<b>Evolution of Precipitate Depleted Zones in Mg-Based Alloys Strengthened by Precipitation Hardening</b>	
A. Katsman, A. Gorny, D. Shepelev and M. Bamberger	153
<b>Influence of Interstitials Content on the Diffusion of Niobium in Alloy 718</b>	
B. Ter-Ovanessian, C. Berrest, J. Deleume, J.M. Cloué and E. Andrieu	161
<b>Interrelation between Hydrogen Desorption Kinetics and Structure of <math>(\text{Mg}_2\text{Ni})\text{H}_x</math> and Hydrogenated Eutectic <math>(\text{Mg}/\text{Mg}_2\text{Ni})\text{H}_y</math></b>	
J. Cermak and L. Král	167
<b>Microstructure of the Passive Layer Formed on Different Austenitic Stainless Steels Implanted with Molybdenum</b>	
C.M. Abreu, M.J. Cristóbal, R. Figueroa, X.R. Nóvoa, G. Pena and M.C. Pérez	175
<b>Synthesis and Characterization of a Porous Silicon Filter with <math>\text{Si}_3\text{N}_4</math> Whiskers</b>	
M. Wong-Sifuentes, M. Nanko and J. Lira-Olivares	185
<b>Effect of the Si Additions on the Mechanical Behaviour and High-Temperature Performance of Hydrogen Sintered 434L Stainless Steels</b>	
A. Bautista, F. Velasco and A. González-Centeno	195
<b>Hydrogen Embrittlement of High Strength Steels</b>	
J. Sanchez, J. Fullea, C. Andrade and P. de Andres	203
<b>Grain Boundary Diffusion of Fe in High-Purity Copper</b>	
J. Ribbe, G. Schmitz and S.V. Divinski	211
<b>Investigation of Phase Transformation of Forged Steel Cold Rolls due to Heat Affecting and Prevent its Failure</b>	
A.A. Mottahedi	219

## Chapter II Diffusion and Coatings

<b>Diffusion Enhanced Rumpling Associated with Martensitic Transformation upon Cycling of Aluminide Bond-Coats</b>	
B. Bouchaud, J. Balmain and F. Pedraza-Diaz	227
<b>Diffusion of a Corroding Electrolyte through Defective Electroplated Ceria Based Coatings</b>	
S. Poupart, F. Pedraza-Diaz and J. Creus	235
<b>Long Term Diffusion Studies in Fe Aluminide Coatings Deposited by Slurry Application on Ferritic Steel</b>	
A. Agüero, V. González and M. Gutiérrez	243
<b>Scanning Kelvin Probe Study on the Stability of the Steel/Coating Interfaces Contaminated by Soluble Salts</b>	
D. de la Fuente, M. Rohwerder, B. Chico and M. Morcillo	253
<b>Diffusion Aluminide Coatings Using Spherical Micro-Sized Aluminium Particles</b>	
M. Juez-Lorenzo, V. Kolarik, H. Fietzek and M. Anchústegui	261
<b>Numerical Determination of Intrinsic Diffusion Coefficient of Aluminide Coatings on Metals</b>	
B. Wierzba, S. Chevalier, O. Politano and M. Danielewski	269
<b>Implications of Diffusion on the Composition and Microstructures of Platinum Modified Aluminide Coatings on CMSX-4 Single Crystal Superalloy</b>	
F. Pedraza-Diaz	277
<b>Post-Discharge Nitriding: Mathematical Modeling and Numerical Simulation of the Layer Growth</b>	
F. Castillo, J. Oseguera-Peña, A. Fraguera and J.A. Gómez	285
<b>Study of the Role of Small Additions of Zr in the CVD- FBR Aluminization Process</b>	
L. Sánchez, F.J. Bolívar, M.P. Hierro and F.J. Pérez	293

## Chapter III Diffusion and Electronic Materials

<b>Magnetic Coupling in <math>\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3/\text{YBa}_2\text{Cu}_3\text{O}_7/\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3</math> Trilayers</b>	
N.M. Nemes, C. Visani, J. Garcia-Barriocanal, F.Y. Bruno, Z. Sefrioui, D. Arias, C. Leon, M. Garcia-Hernandez, S.G.E. Te Velthuis, A. Hoffmann and J. Santamaría	303
<b>The Electrolytic Actuator-An Effect Dominated by Dissipative Currents</b>	
H. Temmen and P. Caracciolo	311

<b>Sedimentation of Impurity Atoms in InSb Semiconductor under a Strong Gravitational Field</b>	319
Y. Iguchi, M. Ono, S. Okayasu and T. Mashimo	
<b>Influence of Pulsed Magnetic Field on the Al-Heterodiffusion in <math>\alpha</math>-Fe</b>	323
A.V. Pokoev and M.A. Verjakovskaya	
<b>Atom Redistribution during co-Doped Amorphous Silicon Crystallization</b>	329
A. Portavoce, D. Mangelinck, R. Simola, R. Daineche and J. Bernardini	
<b>First Study of Oxygen Diffusion in a ZnO - Based Commercial Varistor</b>	339
A.C.S. Sabioni, A.M.J.M. Daniel, R. Metz, A.M. Huntz and F. Jomard	
<b>Dynamics of Mobile Oxygen Ions in Disordered Pyrochlore-Type Oxide-Ion Conductors</b>	347
M.R. Díaz-Guillén, K.J. Moreno, J.A. Díaz-Guillén, A.F. Fuentes, J. García-Barriocanal, J. Santamaría and C. Leon	

## Chapter IV Diffusion and Intermetallics

<b>Formation of Amorphous Graded Structure in <math>\text{Bi}_3\text{Pb}_7</math> Intermetallic Compounds under Strong Gravitational Field</b>	357
T. Mashimo, Y. Iguchi, R. Bagum, T. Sano, S. Takeda, S. Kimura, O. Sakata, M. Ono, S. Okayasu, T. Tsurui and K. Hiraga	
<b>Triple-Defect B2 Binary Intermetallics: Bragg-Williams Solution and Monte Carlo Simulations</b>	361
A. Biborski, L. Zosiak and R. Abdank-Kozubski	
<b>Characterization of Intermetallic Layer with Nanoresolution Using X-Ray Standing Wave Technique</b>	369
C. Cserháti, Z. Erdélyi, Z. Balogh, L. Daróczsi, A. Csik, G.A. Langer, M. Varga, I. Zizak, A. Erko and D.L. Beke	
<b>Diffusion of Titanium and Nickel in B2 NiTi</b>	377
S.V. Divinski, I. Stloukal, L. Král and C. Herzig	

## Chapter V Diffusion and Oxidation Processes

<b>Growth Mechanism vs Matter Transport in Thermally Growing Oxides on High Temperature Materials: A Brief Survey Based on the Case Study of Alumina Formers</b>	385
J. Jedlinski	
<b>Characterisation of the Oxide/Metal Interface of Fluorine Treated Titanium Aluminides</b>	397
P.J. Masset, M. Laurent and M. Schütze	
<b>Diffusion of Oxygen in Thermally Grown Oxide Scales</b>	405
S. Chevalier	
<b>Evaluation of Si Coating on Ferritic Steels by CVD-FBR Technology in Steam Oxidation</b>	413
F.J. Bolívar, L. Sánchez, M.P. Hierro and F.J. Pérez	
<b>Graded Nitrogen Ingress in FCC Metallic Structures and the Related Microstructures and High Temperature Oxidation Behaviour</b>	421
F. Pedraza-Díaz, J.L. Grosseau-Poussard, J.F. Dinhut, J. Balmain and G. Bonnet	
<b>On the Mechanism of <math>\text{Cu}_2\text{O}</math> Oxidation at High Temperatures</b>	429
Z. Grzesik and M. Migdalska	
<b>Studies of the Effectiveness of Certain High Performance Coatings in Preventing Hot Corrosion Degradation of Ti-Aluminide Alloys</b>	437
D. Tomasz, A. Wilson, H.G. Ahmad and P.K. Datta	
<b>A Thermodynamic Approach of the Mechano-Chemical Coupling during the Oxidation of Uranium Dioxide</b>	447
N. Creton, V. Optasanu, T. Montesin, S. Garruchet and L. Desgranges	
<b>Oxidation Behaviour of Stainless Steel Matrix with TiC and TiC+TiB<sub>2</sub> SHS Powders in a Thermal Spray Process</b>	455
J. Fernández, A. Isalgue, I.G. Cano and J.M. Guilemany	
<b>Behaviour of Aluminide Diffusion Coatings on HCM12-A Steel by Al/Ce and Al/La CVD-FBR in Oxidation.</b>	461
L. Sánchez, F.J. Bolívar, M.P. Hierro and F.J. Pérez	

<b>The Influence of CVD-FBR Coatings on HCM12 Corrosion Behaviour under Molten Salt Conditions</b>	469
J. Nieto, M.P. Hierro, F.J. Bolívar and F.J. Pérez	469
<b>Metal Dusting Corrosion of 9Cr-1Mo Steel in Propane-Butane Gas Mixture</b>	477
Z. Grzesik, M. Danielewski and S. Mrowec	477
<b>Influence of the Processing Parameters on the Nature of Oxides Formed on Sintered Stainless Steels during High-Temperature Exposures</b>	485
A. Bautista, C. Moral and F. Velasco	485
<b>Establishment of Thermally Grown Oxides upon the Early Oxidation Stages of Ni20Cr and Ni30Cr</b>	493
B. Bouchaud, L. Douminge and F. Pedraza-Diaz	493
<b>An Insight on the Influence of Ion Implantation on the Pitting Corrosion Resistance of AISI 430 Stainless Steel</b>	501
C.M. Abreu, M.J. Cristóbal, P. Merino, G. Pena and M.C. Pérez	501

## Chapter VI Diffusion and Oxides

<b>Oxygen Uptake and Diffusion in Mayenite</b>	511
M. Kilo, S. Swaroop and M. Lerch	511
<b>Strong-Gravity Effect on Twinned Y<sub>1</sub>Ba<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> Single Crystal</b>	517
R. Bagum, S. Okayasu, Y. Iguchi, M. Ono and T. Mashimo	517
<b>Study of Oxygen Diffusion in Polycrystalline ZnO by SIMS</b>	523
A.C.S. Sabioni, A.M.J.M. Daniel, A.M. Huntz, W.B. Ferraz and F. Jomard	523
<b>Oxygen and Silicon Diffusion in Silica under Varying Ambient Conditions</b>	531
K. Sunder and H. Bracht	531
<b>The Oxide Scale Growth Mechanism on Fe20Cr5Al+RE Alloy in SO<sub>2</sub>+O<sub>2</sub></b>	541
J. Jedlinski, Z. Żurek, M. Homa, G. Smoła and J. Camra	541
<b>Determination of Diffusion Coefficients of Oxygen Vacancies in La<sub>0.58</sub>Sr<sub>0.4</sub>Co<sub>0.2</sub>Fe<sub>0.8</sub>O<sub>3-δ</sub> Perovskite Type Oxides</b>	551
D. Schlehuber, E. Wessel, L. Singheiser and T. Markus	551

## Chapter VII Diffusion and Stresses

<b>Interface Diffusion in Cu Processed by Means of Surface Mechanical Attrition Treatment</b>	557
Z.B. Wang, K. Wang, K. Lu, G. Wilde and S.V. Divinski	557
<b>Li Conductivity of Nanocrystalline Li<sub>4</sub>Ti<sub>5</sub>O<sub>12</sub> Prepared by a Sol-Gel Method and High-Energy Ball Milling</b>	565
W. Iwaniak, J. Fritzsche, M. Zukalová, R. Winter, M. Wilkening and P. Heitjans	565

## Chapter VIII Diffusion in Thin Films

<b>Thin Film Dissolution into Semi-Infinite Substrates: Surprising Interface Kinetics and Dissolution Modes</b>	573
Z. Erdélyi, C. Girardeaux, D.L. Beke, J. Bernardini, A. Portavoce, G.L. Katona, Z. Balogh and A. Rolland	573
<b>On the Formation of Unusual Diffusion Profiles in Cd<sub>x</sub>Zn<sub>1-x</sub>Te Crystals after Implantation of Different Elements</b>	587
H. Wolf, F. Wagner, J. Kronenberg and T. Wichert	587
<b>Evolution of Concentration Profiles and Diffusion Paths in Single-Phase Multicomponent Multilayered Assemblies</b>	593
K.N. Kulkarni and M.A. Dayananda	593
<b>Unusual Behaviour of the Dissolutions Kinetics of one Monolayer of Si in Cu(001)</b>	601
B. Lalmi, C. Girardeaux, A. Portavoce, J. Bernardini and B. Aufray	601

## Chapter IX Diffusion in Glasses and Liquids

<b>Self Diffusion in Liquid Titanium: Quasielastic Neutron Scattering and Molecular Dynamics Simulation</b>	609
A. Meyer, J. Horbach, O. Heinen, D. Holland-Moritz and T. Unruh	
<b>Alkaline-Earth Diffusion in Mixed Cation Glasses</b>	615
M. Grofmeier, F.V. Natrup and H. Bracht	

## Chapter X Diffusion in Nanomaterials

<b>Diffusion in Nanostructured Materials</b>	623
S.V. Divinski	
<b>Emission Mössbauer Spectroscopy of Grain Boundaries in Poly- and Nanocrystalline Metals</b>	633
V.V. Popov	
<b>Grain Boundary Diffusion in Recrystallizing Nanocrystalline Materials</b>	641
L. Klinger, Y. Amouyal, S.V. Divinski and E. Rabkin	
<b>Formation of a Nano-Hole via Oxidation of Metal Nanoparticles</b>	649
R. Nakamura, H. Nakajima and H. Mori	
<b>Surface-Sandwich Segregation Phenomena in Bimetallic Ag-Ni and Pd-Ni Nanoparticles: A Molecular Dynamics Study</b>	657
E.V. Levchenko, A.V. Evteev, I.V. Belova and G.E. Murch	
<b>Composition Effect on Shrinkage of Hollow Binary Alloy Nanospheres</b>	665
A.V. Evteev, E.V. Levchenko, I.V. Belova and G.E. Murch	
<b>Shrinkage of Hollow Nanoparticles of Oxides of Cu and Ni at High Temperatures</b>	673
R. Nakamura, H. Nakajima and H. Mori	
<b>Essay on Techniques &amp; Physics of Some Diffusion-Controlled Processes in Materials: Relevance to Nanofabrication Applications</b>	679
Y.S. Nechaev and A. Öchsner	

## Chapter XI Fundamentals in Diffusion

<b>Impact of Carbon on the Diffusion of Donor Atoms in Germanium</b>	689
H. Bracht, S. Brotzmann and A. Chroneos	
<b>Diffusion in Isotope Heterostructures Investigated by Neutron Reflectometry</b>	697
E. Hüger, J. Stahn, U. Geckle, M. Bruns and H. Schmidt	
<b>Atomic Diffusion and its Relation to Thermodynamic Forces in Al-Ni Melts</b>	705
A. Griesche, B. Zhang, J. Horbach and A. Meyer	
<b>Solute Diffusion in Grain Boundaries – Outside the Scope of Fisher Model</b>	711
A. Rodin, L. Klinger and B.S. Bokstein	
<b>Concentration Characteristics of Diffusion-Induced Recrystallization</b>	719
G. Schmitz, B. Kruse, D. Baither and T.H. Kim	
<b>Jump Frequencies of Cd Tracer Atoms in L1<sub>2</sub> Lanthanide Gallides</b>	725
X. Jiang, M.O. Zacate and G.S. Collins	
<b>Computer Simulation of Diffusion in Dilute Al-Fe Alloys</b>	733
M. Mendelev, A. Rodin and B.S. Bokstein	
<b>Following the First Steps of UV Degradation of High Density Polyethylene by Fluorescence Spectroscopy</b>	741
L. Douminge, S. Mallarino, X. Feaugas and J. Bernard	
<b>First-Principle Calculation of Monovacancy and Divacancy Interactions with Atomic Oxygen in Nickel: Thermal Expansion Effects</b>	747
C. Mijoule, E.H. Megchiche, E. Andrieu and D. Monceau	
<b>Motion of Cadmium Tracer Atoms in Al<sub>11</sub>R<sub>3</sub> Phases (R=La,Ce,Pr)</b>	755
S. Lage and G.S. Collins	
<b>Determination of Grain Boundary Diffusion Coefficients in C-Regime by Hwang-Balluffi Method: Silver Diffusion in Pd</b>	763
Z. Balogh, Z. Erdélyi, D.L. Beke, A. Portavoce, C. Girardeaux, J. Bernardini and A. Rolland	
<b>Oxygen Diffusion and Surface Exchange in Yttria-Stabilized Zirconia and Gadolinia-Doped Ceria Ceramics at Low Temperatures</b>	769
K. Kowalski	

**Doping Effect in Nickel Oxide**

Z. Jurasz, K. Adamaszek, R. Janik, Z. Grzesik and S. Mrowec

775