

Table of Contents

Preface

Chapter 1: Physical and Mechanical Metallurgy of Ni-Based Superalloys

Effects of Solid Solution Temperature on Microstructure and Properties of Extruded and Forged FGH95 Superalloys Z.C. Peng, X.Q. Wang, Y. Zhang, Y.F. Feng and X.S. Fan	3
Microstructure-Dependent Deform Behavior of a Polycrystalline Ni-Based Superalloy Based on Micropillar Compression G.F. Tian, Y. Chen, B. Gan, Y. Yang and J.W. Zou	8
Heat Treatments Effects on Nickel-Based Superalloy Inconel 713C B.B. Galizoni, A.A. Couto and D.A.P. Reis	16
Investigation on Microvoid Nucleation of High Temperature Nickel Based Superalloy under Thermal Shock X.C. Shang, Y.T. Xu and P.F. Wu	25
Effects of Original Microstructure on Hot Deformation Behavior and Microstructure of a P/M Ni-Base Superalloy C.Y. Wang, X.J. Song and J.W. Zou	30
Comparison of Semisolid Microstructure Evolution of Wrought Nickel Based Superalloy GH4037 with Different Solid Fraction G.F. Xiao, J.F. Jiang, Y. Wang and Y.Z. Liu	37
Low Cycle Fatigue Life Evaluation According to Temperature and Orientation in Nickel-Base Superalloy I.K. Heo, D.H. Yoon and J.H. Kim	43
Low-Temperature Superplasticity of the Ni-Based EK61 Superalloy and Application of this Effect to Obtain Solid Phase Joints E. Galieva, V. Valitov, R. Lutfullin and A. Bikmukhametova	49
Observations on Dynamic Strain Aging Manifestation in Inconel 718 Superalloy M.C. Rezende, L.S. Araújo, S.G. Borborema, J. Dille and L.H. de Almeida	54
Service Temperature Evaluation of Cast K465 Superalloy Turbine Vane Based on Microstructural Evolution Z. Zheng, J.Y. Zhou, W.X. Zhao and Y.R. Zheng	59
Microstructure Evolution of Nickel-Based Superalloys Induced by Thermomechanical Processing - Simulation and Verification S. Mukhtarov, F.Z. Utyashev and R. Shakhev	69
Study of Mechanical Degradation and Microstructural Characterization in a Ni-Based Superalloy Component of a Gas Turbine E.O. Avila-Davila, V.M. Lopez-Hirata, M.L. Saucedo-Muñoz, L.M. Palacios-Pineda, I. Ramirez-Vargas, M.M. Cueto-Rodriguez, L.G. Trapaga-Martinez and J.M. Alvarado-Orozco	75
Deformation Twinning Behavior in High Ni-Austenitic Materials J. Nordström, R. Siriki, J. Moverare and G.C. Chai	81
Hot Corrosion of Alloy 617 OCC in Simulated USC Power Plant Environment N. Arivazhagan, P.R. Hari, M.N. Rao and A.H.V. Pavan	87
Segregation and Precipitation Behavior of Phosphorus in a Ni-Fe-Cr Base Wrought Superalloy S. Zhang, A.W. Zhang, W.Y. Wang, X. Xin and K. Zhang	93

Chapter 2: Single-Crystal and Directionally Solidified Superalloys

Creep Properties and Microstructural Evolution at 760°C/785MPa of a Re-Containing Single Crystal Superalloy Y.S. Zhao, Y.F. Liu, J.X. Zhao, X.T. Zhang, Y. Yang, H. Chen, H. Jiang and Y.S. Luo	103
---	-----

Deformation Features of a High Mo Nickel-Based Single Crystal Superalloy during Creep at High Temperature	108
H.J. Yan, S.G. Tian, G.Q. Zhao and S.K. Zhang	
Creep Damage of a Re/Ru-Containing Single Crystal Nickel-Based Superalloy at Elevated Temperature	116
G.Q. Zhao, S.G. Tian, S.K. Zhang, N. Tian and L.R. Liu	
Features of the Formation of Structure and Phases in Single-Crystal High-Temperature Alloys and their Effect on Mechanical Properties	123
N.A. Popov, K.I. Lugovaya and A.Y. Zhilyakov	
Thermodynamic Study on Equilibrium Phases in Nickel-Base Single Crystal Superalloys	128
J.S. Wang	
Formation of Secondary Phases in the Boundary between Surface Defect Grains and Matrix in Third Generation Nickel-Based Single Crystal Superalloy Turbine Blades	134
K.H. Park and P. Withey	
The DSC Investigation on Phase Transformations of Directionally Solidified (DS) and Powder Metallurgy (PM) Ni-Base Superalloys	140
L. Zheng, Y.F. Liu, M.J. Gorley, Z.L. Hong, S. Day, C.C. Tang, Z. Li, C.B. Xiao and G.Q. Zhang	

Chapter 3: Polycrystalline Low Nickel Superalloys

Thoughts on High Performance Superalloy Design and Microstructural Characteristics of a Newly Designed Ni-Cr-Co-W Superalloy Applied above 850°C	149
X.M. Xiang, H. Jiang, J.X. Dong and Z.H. Yao	
Influence of Water Vapor on Oxide Scale Morphology of Incoloy800HT at 850°C	161
A. Srisrual, K. Pitaksakorn and P. Promdirek	
Study on Heat Treatment of a Low Nickel Superalloy Used for Automotive Valves	166
Y. Mo, D.Z. Wang, H.D. Liu, L. Du, Y.L. Liu, H. Wan and G.P. Huang	
Corrosion Behavior of Incoloy 825 in High Temperature Vapor Containing Sodium Chloride	170
J.Q. Yang, S.Z. Wang, D. Wang, J.N. Li and D.H. Xu	
An Improved Omega-Based Method for Creep Life Prediction Using Hyperbolic Sine Stress Correlation	175
X. Yang, R. Barrett, S.B. Leen and J.M. Gong	
Creep Damage Mechanisms in Cast Cobalt Superalloys for Applications in Glass Industry	182
M. Kvapilová, B. Podhorná, J. Dvořák, P. Král, J. Zýka, K. Hrbáček and V. Sklenička	
Impact of L1₂-Ordered Precipitation on the Strength of Alumina-Forming Austenitic Heat-Resistant Steels	188
B.B. Zhao, X.P. Dong, F. Sun and L.T. Zhang	

Chapter 4: Superalloys Processing and Manufacturing

Optimization of Spot Welding Parameters in Similar and Dissimilar Alloys AISI-321 and Inconel-X750 Alloys	197
M. Rauf, A.N. Khan, I.U. Salam, R. Qayyume and S. Khan	
Effect of Hot Extrusion on the Flow Behaviour of a Nickel-Based P/M Superalloy	204
J.Y. Si, S.H. Liu and L. Chen	
Effects of Preheating Temperature at Primary Shear Zone in Laser Assisted Milling Process	213
K. Jamkamon, K. Yamada, K. Sekiya and R. Tanaka	
Evaluation of Surface Roughness and Tool Wear in High Speed Machining of Inconel 718	219
M.M. Reddy and V.Y.C. Nie	
The Enhanced Ability to Withstand Axial Hot Compression of Electropulsing-Assisted Ultrasonic Surface Rolling Process Treated Inconel 718	225
Z.Y. Sun, T.M. Hu, S. Ren and B. Li	
Experimental Study of Cutting Performance for Inconel 718 Milling by Various Assisted Machining Techniques	231
S.Y. Lin and B.H. Yang	

Fabrication and EDM Corrosion Resistance of Copper Electroforming Layer on Tube Electrode for Aero-Engine Blade Cooling Hole in EDM Process Z.Y. Li, Q.W. Cui, B. Chen, J. Xu and H. Guo	237
The Influence of Laser Drilling Process on the Microstructural Changes of Nickel Based Superalloy S. Petronic, A. Milosavljevic, M. Burzić, O. Eric-Cekic, S. Polic and R. Jovicic	246
Microstructure Characterization of Superalloy 718 during Dissimilar Rotary Friction Welding M. Cheepu, D. Venkateswarlu, P.N. Rao, V. Muthupandi, K. Sivaprasad and W.S. Che	254
Microstructure Characterization in Dissimilar TIG Welds of Inconel Alloy 718 and High Strength Tensile Steel M. Anuradha, V.C. Das, D. Venkateswarlu and M. Cheepu	261
Mechanical Properties and Fatigue Resistance of 3D Printed Inconel 718 in Comparison with Conventional Manufacture I. Černý, J. Kec, T. Vlasák, L. Remar, M. Jersák and M. Zetek	267
Failure Analysis of Hot Clamp Induced Cracking on Hydrogen Reformer Outlet Pigtail Tubes L.W. Cao, G.S. Xie and M.Z. Zhao	273
Solution Treatment Process of Haynes 230 Cylindrical Blank Used for Hot Flow Spinning X. Xu, Z.Y. Li, G.F. Xiao and Q.X. Xia	279
Research of Effect of the Powder Material Quality in the Structure Formation of the DLD Inconel 718 Samples S.S. Silchonok, G.G. Zadykyan, O.G. Zotov and I.N. Morozova	285
Analysis of Dimensional Accuracy (Over Cut) and Surface Quality (Roughness) in Electrical Discharge Machining of Inconel-718 Alloy R. Kumar, A. Pandey and P. Sharma	291
Optimization of Process Parameters in the Turning Operation of Inconel 625 H. Vasudevan, R. Rajguru, M. Shaikh and A. Shaikh	297
Investigation of the Impact of Cutting Parameters on Surface Integrity in the End Milling of Inconel 625 R. Rajguru and H. Vasudevan	303
The Study of Deformability of Heat-Resistant Alloy Named “Inconel Alloy 625” for Estimation of Plates Production Possibility at Wide-Strip Rolling “Mill 2300” N.S. Deryabin	309
Yb: YAG Laser Welding of Aeronautical Alloys J. Alexis, J.D. Beguin, P. Cerra and Y. Balcaen	314
Laser Beam Welding of IN792 DS Superalloy G. Barbieri, F. Cognini, V. Bonaiuto, R. Montanari, M. Richetta and A. Varone	320
Selective Laser Melting of Inconel 718 under High Power and High Scanning Speed Conditions Y. Tachibana, T.T. Ikeshoji, K. Nakamura, M. Yonehara and H. Kyogoku	326
Compositional Optimization of In718 Superalloy Powder for Additive Manufacturing C.Y. Lin, H.Y. Bor, C.N. Wei and C.H. Liao	331

Chapter 5: Coatings for Superalloys

Investigation of Hot Section (Nozzle Guiding Vane) Distress due to Interaction of Thermal Barrier Coatings with CMAS Q. Ahmed, I.N. Qureshi and I.U. Salam	339
Microstructural Change and Fracture Behavior under Different Heat Exposure Conditions on Thermal Barrier Coatings Deposited on TiAl Intermetallic Compound M. Hasegawa, K. Hirata and I. Dlouhý	345
Development of Evaluation Method for Damage of Oxidation CoNiCrAlY Coating M. Chen, K. Yoshikawa, Z.Q. Song and S. Zhu	352
Experimental Study of High Velocity Oxygen Fuel Sprayed Cr₃C₂- Ni-Cr-B-Si Coatings on Inconel 718 Using Design of Experiments R. Shankar, K.R. Balasubramanian and S.P. Sivapirakasam	357

Features of Creating Nanostructured Intermetallic Ti-Al-Si-Cr Coatings for the Hot Section Part of Gas Turbine Engines	364
A. Urbahs and K. Savkovs	
Microstructure and Positron Lifetimes of Aluminide Coatings on Inconel 713	371
J. Romanowska, E. Dryzek and M. Zagula-Yavorska	
Degradation of HVOF Sprayed Hastelloy C-276 Local Mechanical Properties after Exposure to High Temperature Corrosion	375
Z. Česánek, J. Schubert and O. Bláhová	
Evaluation of Microstructure, Phase Composition and Hardness of Alternative Abradable Ceramic Coating Systems Produced by Means of Atmospheric Plasma Spraying	381
D. Jech, M. Remešová, P. Komarov, S. Tkachenko, Z. Česánek, J. Schubert, Š. Houdková and L. Čelko	
Hydrogen Influence on Microstructure and Properties of Novel Explosive Welded Corrosion Resistant Clad Materials	387
M. Gloc, H. Słomińska and Ł. Ciupiński	
Laser Surface Treatment of Sintered Stainless Steels for Wear Resistance Enhancement	393
Z. Brytan and W. Pakieła	
Thermo-Physical Properties Measurement of Advanced TBC Materials with Pyrochlore and Perovskite Structures	400
N. Ejaz, L. Ali, A. Ahmad, M. Mansoor, M.M. Asim, A. Rauf and K. Mehmood	
Microstructure and Abrasive Wear Behaviour of Nickel Based Hardfacing Stainless Steel Deposited by Gas Metal Arc Welding	409
B. Suresha, S.G. Channabasavanna and N.S. Shanmugam	
Study of Wear on Nicraly Coating Sprayed by HVOF on 316 Steel and Laser CO₂ Remelting Process	415
S.A. Silva, A.C.C. Oliveira, G.R. Pita, M.F.S. Ferreira and G. de Vasconcelos	
Preparation of Dense Al₂O₃ Film on 8YSZ Coating by Sol-Gel Method	420
M. Wang, Z.Y. Wang, Y.J. Yuan and W. Pan	
The Impedance Spectroscopy Study of the Oxides Layer in Thermal Barrier Coatings	427
Z.Y. Wang, M. Wang, Y.J. Yuan and W. Pan	
Influence of Zirconia Powder Fractional Composition on Microstructure and Properties of Thermal Barrier Coating Obtained by Thermal Spraying	433
V.Y. Hristosova, O.S. Bondareva and S. Konovalov	

Chapter 6: Superalloys Deformation and Property Computational Modelling

Comprehensive Numerical Simulation of Stress and Damage Fields under Thermo-Mechanical Loading for TBC-Coated Ni-Based Superalloy	441
H. Katori, M. Arai and K. Ito	
Thermal Deformation Behavior and Formability of High Temperature with Corrosion Resistance Alloy	447
G.U. Jeong, J. Park, C.K. Jin, Y.H. Moon and C.G. Kang	
Comparison of Different FEM Software in Terms of Hot Ultrasonic Assisted Machining Technique	456
M.A. Sofuoğlu, M.C. Kushan and S. Orak	
Establishment of the High Temperature Constitutive Relationship of the Haynes 230 Ni-Based Superalloy	461
X.Q. Cheng, N.Y. Zhu, Q.X. Xia and G.F. Xiao	
Connecting the Microstructure Stability of Ni Based Superalloys to their Chemical Compositions	467
H. Yu, W. Xu and S. van der Zwaag	
Machining of Hastelloy-X Based on Finite Element Modelling	476
F.H. Çakır, M.A. Sofuoğlu and S. Gürgen	
Development of Multi-Objective Prediction Model for Wire Electrical Discharge Machining of Inconel 718 Nickel-Based Superalloy	483
C.B. Yang, C.G. Lin, H.L. Chiang and J.L. Zhan	

Prediction of Material Removal in Extrusion Honing of Hastelloy C22 Using Artificial Neural Network

V.R. Devadath and H.P. Raju

491

Modeling of the Structure of Heat-Insulating Semi-Transparent Materials and Coatings for Industrial and Transport Power Plants

V.G. Merzlikin, T.V. Zhubreva and A.V. Kostukov

497

Microstructure Analysis and Creep Behaviour Modelling of Powder Metallurgy Superalloy

W.Y. Xu, Z.C. Peng, M.Z. Li and M.S. Pham

503