

# Table of Contents

## Preface

## Chapter 1: Synthesis, Processing and Microstructure of High-Entropy Alloys

|   |    |
|---|----|
| <b>Synthesis and Characterization of Novel High Entropy Alloys</b><br>A. Kumar, B. Vinith, A.K. Choudhary and M.K. Chopkar  | 3  |
| <b>Preparation of a Light-Weight MgCaAlLiCu High-Entropy Alloy</b><br>X.H. Du, R. Wang, C. Chen, B.L. Wu and J.C. Huang   | 10 |
| <b>Microstructure of Rapidly Solidified Melt-Spun Ribbon in AlCoCrFeNi<sub>2.1</sub> Eutectic High-Entropy Alloys</b><br>T. Nagase, M. Takemura and M. Matsumuro  | 14 |
| <b>Characterization of Powder Metallurgy High-Entropy Alloys Prepared by Spark Plasma Sintering</b><br>L. Moravcikova-Gouvea, I. Moravcik, J. Cizek, P. Krajnakova, V. Jan and I. Dlouhy  | 19 |
| <b>Effect of Cold Rolling on the Microstructure and Hardness of Al<sub>5</sub>Cr<sub>12</sub>Fe<sub>35</sub>Mn<sub>28</sub>Ni<sub>20</sub> High Entropy Alloy</b><br>S. Elkhatatny, M.A.H. Gepreel and A.S. Hamada                                | 25 |
| <b>Influence of High-Pressure Torsion on the Microstructure and the Hardness of a Ti-Rich High-Entropy Alloy</b><br>A. Heczel, L. Liljensten, J. Bourgon, L. Perrière, J.P. Couzine, I. Guillot, G. Dirras, Y. Huang, T.G. Langdon and J. Gubicza | 30 |
| <b>Use of Novel Welding Technologies for High-Entropy Alloys Joining</b><br>S. Zherebtsov, N. Stepanov, D. Shaysultanov, S. Malopheyev, I. Vysotskiy, V. Sanin, N. Kashaev and R. Kaibyshev   | 36 |
| <b>Characterization of Laser Beam Welded Al<sub>0.5</sub>CoCrFeNi High-Entropy Alloy</b><br>R. Sokkalingam, K. Sivaprasad, V. Muthupandi and M. Duraiselvam   | 42 |
| <b>CoCrFeNiMo High Entropy Alloy Produced by Solid State Processing</b><br>I. Csáki, S.N. Karlsdóttir, S. Serghiuă, G. Popescu, M. Buzatu, L.E. Geambazu and C.A. Manea   | 48 |
| <b>Structural and Microstructural Characterization of CoCrFeNiPd High Entropy Alloys</b><br>M. Calvo-Dahlborg, J. Cornide, U. Dahlborg, S. Chambreland, G.D. Hatton and A. Fones  | 53 |
| <b>Investigation of Lattice Defects in a Plastically Deformed High-Entropy Alloy</b><br>A. Heczel, Y. Huang, T.G. Langdon and J. Gubicza  | 57 |
| <b>Annealing Effects on the Microstructure and Properties of Vanadium and Molybdenum Rich FCC High Entropy Alloy</b><br>M. Patnamsetty, A. Saastamoinen and P. Peura  | 63 |
| <b>Interfacial Reaction of CoCrFeNi High Entropy Alloy in Molten Al</b><br>Y. Hu, J.T. He, Y.C. Wu, Y. Dong and Z.R. Zhang  | 70 |
| <b>Microstructure of Co-Cr-Fe-Mn-Ni-Cu and Co-Cr-Fe-Mn-Ni-Ag High Entropy Alloys with Liquid Phase Separation</b><br>T. Nagase  | 76 |
| <b>Microstructural Evolution in MgAlLiZnCaY and MgAlLiZnCaCu Multicomponent High Entropy Alloys</b><br>K.S. Tun and M. Gupta  | 80 |
| <b>Al, Cu and Zr Addition to High Entropy Alloys: The Effect on Recrystallization Temperature</b><br>E. Colombini, A. Garzoni, R. Giovanardi, P. Veronesi and A. Casagrande   | 85 |
| <b>Effect of Aluminum Addition on Al<sub>x</sub>CoFeMnNiZn Multi-Component Production</b><br>A. Suksamran, N. Worauaychai, N. Tosangthum, T. Yodkaew, R. Krataitong, P. Wila and R. Tongstri  | 91 |
| <b>Phase Stability and Mechanical Properties of FCC Structural CoCrCu<sub>0.5</sub>FeNi High-Entropy Alloy with Silicon or Boron Addition</b><br>C. Chen, N. Liu, P.J. Zhou and H.F. Xiang  | 98 |

## Chapter 2: Mechanical Properties of High-Entropy Alloys

|   |     |
|---|-----|
| <b>Microstructure and Mechanical Properties Investigation of New <math>\text{Al}_{10}\text{Cr}_{12}\text{Mn}_{28}\text{Fe}_{(50-x)}\text{Ni}_{(x)}</math> High Entropy Alloys</b> |     |
| A.W. Abdel-Ghany, S. Elkatatny and M.A.H. Gepreel   | 113 |
| <b>The Influence of Chromium Content on the Structural and Mechanical Properties of <math>\text{AlCr}_x\text{FeCoNi}</math> High Entropy Alloys</b>                               |     |
| V. Geantă, I. Voiculescu, B. Istrate, M.D. Vrânceanu, R. Ciocoiu and C.M. Cotru   | 119 |
| <b>Microstructure and Mechanical Properties of Equiautomic <math>\text{CrMnCoNiCu}</math> High Entropy Alloy</b>  |     |
| S.M. Oh and S.I. Hong   | 125 |
| <b>Microstructural Evolution and Mechanical Properties in a <math>\text{Mn}_{1.05}\text{Fe}_{1.05}\text{CoNiCu}_{0.9}</math> High Entropy Alloy</b>                               |     |
| S.M. Oh and S.I. Hong   | 130 |
| <b>Microstructure and Mechanical Properties of Equitomic <math>\text{CoCrFeCuNi}</math> High Entropy Alloy</b>  |     |
| S.M. Oh and S.I. Hong   | 136 |
| <b>Solidification Microstructure and Mechanical Properties of Bulk Near-Eutectic <math>\text{AlCoCrFeNi}_{2.2}</math> High Entropy Alloy</b>                                      |     |
| X. Huang, Y. Hu, Z.T. Wu, Y. Dong, C.Q. Li, Y.Q. Cheng and Z.R. Zhang   | 142 |
| <b>Strengthening of a <math>\text{CoCrFeNiMn}</math>-Type High Entropy Alloy by Regular Arrays of Nanoprecipitates</b>  |     |
| N. Stepanov, D. Shaysultanov, M. Klimova, V. Sanin and S. Zherebtsov  | 148 |
| <b>Effect of Al Content on Microstructure and Properties of <math>\text{Al}_x\text{MoNbTiV}</math> RCCA's Alloys</b>  |     |
| A. Lacour-Gogny-Goubert, Z. Zhao-Huvelin, A. Bachelier-Locq, I. Guillot and A. Denquin  | 154 |
| <b>Microstructure Refinement in the <math>\text{CoCrFeNiMn}</math> High Entropy Alloy under Plastic Straining</b>   |     |
| N. Stepanov, D. Shaysultanov, N. Yurchenko, M. Klimova, S. Zherebtsov and G. Salishchev   | 160 |
| <b>Microstructures and Phase Formation of Refractory <math>\text{MoNbTaVZr}</math> High Entropy Alloy</b>   |     |
| H.Y. Wang, Z.Y. Wang, Z.S. Nong, J.J. Wang, T.N. Man and J.C. Zhu   | 166 |
| <b>Microstructure and Mechanical Properties of <math>\text{VTaTiMoAl}_x</math> Refractory High Entropy Alloys</b>   |     |
| D.X. Qiao, H. Jiang, X.X. Chang, Y.P. Lu and T.J. Li  | 173 |
| <b>Temperature Dependent Yield Strength, Strain Hardening and Failure of the <math>\text{CoCrFeNiMnV}_x</math> High Entropy Alloys</b>  |     |
| A.V. Podolskiy, E.D. Tabachnikova, M.O. Laktionova, N.A. Bereznaia, M.A. Tikhonovsky, A.S. Tortika, J. Miškuf, K. Csach, A. Juríková and M. Hurakova                              | 178 |
| <b>Creep Behaviors of <math>\text{CrMnFeCoNi}</math> High Entropy Alloy at Intermediate Temperatures</b>  |     |
| Y.B. Kang, K.H. Lee and S.I. Hong   | 184 |
| <b>Developing Superplasticity in High-Entropy Alloys Processed by Severe Plastic Deformation</b>  |     |
| H. Shahmir, M. Kawasaki and T.G. Langdon  | 190 |
| <b>Study on Wear Resistance <math>\text{FeNiCrMnAl}</math> High Entropy Alloy - Mechanical Properties</b>   |     |
| G. Buluc, R. Chelariu, G. Popescu, M. Sârghi and I. Carcea  | 196 |
| <b>Promising Ballistic Behavior of <math>\text{CoCrFeMnNi}</math> High Entropy Alloy</b>  |     |
| F.d.C.G. Filho, F.S. da Luz, A.B. da Silva Figueiredo, S.N. Monteiro and D.S. dos Santos  | 201 |
| <b>High Compressibility <math>\text{ZrTiHfV}_{0.5}\text{Nb}_{0.5}\text{C}_x</math> Refractory High-Entropy Alloys</b>   |     |
| W.K. Chen, Y.K. Li and Y.W. Chen  | 207 |

## Chapter 3: Phenomenological and Computational Investigations of High-Entropy Alloys Properties

|   |     |
|---|-----|
| <b>The Valence Electron Structure of High-Entropy Alloys</b>                                  |     |
| B. CHENG, Y.K. Li and G.Q. Hou  | 215 |
| <b>Phenomenological Investigations on Diffusion Kinetics in Multicomponent Metallic Melts</b> |     |
| W.M. Chen, X. Yang and L.J. Zhang   | 220 |

|  |     |
|--|-----|
| <b>A Mystery of "Sluggish Diffusion" in High-Entropy Alloys: The Truth or a Myth?</b>                | 248 |
| S.V. Divinski, A.V. Pokoev, N. Esakkiraja and A. Paul  |     |
| <b>Investigation of Interdiffusion in High Entropy Alloys: Application of the Random Alloy Model</b> | 284 |
| M. Afikuzzaman, I.V. Belova and G.E. Murch   |     |
| <b>On the Self - and Impurity Diffusion in High Entropy Alloys</b>                                   | 299 |
| D.L. Beke and G. Erdélyi   |     |
| <b>Periodic Maximum Entropy Random Structure Models for High-Entropy Alloys</b>                      | 309 |
| W.Q. Feng, S.M. Zheng, Y. Qi and S.Q. Wang   |     |

## Chapter 4: High-Entropy Alloy Based Coatings and Composites

|   |     |
|---|-----|
| <b>Synthesis and Phase Investigation of Equiatomic AlCrFeMnNi Alloys Dispersed with Partially Stabilized Zirconia for Nuclear Applications</b>  | 323 |
| K. Raja Rao and S.K. Sinha  |     |
| <b>Enhanced Mechanical Properties of Ti(C,B)-Based Cermets with Multi-Component AlCoCrFeNi High-Entropy Alloys Binder</b>   | 330 |
| G. Zhu, S.X. Sun, J.L. Chen, M. Xie and J.Q. Hu   |     |
| <b>Microstructures and Wear Resistance of Al<sub>1.5</sub>CrFeNiTi<sub>0.5</sub> and Al<sub>1.5</sub>CrFeNiTi<sub>0.5</sub>W<sub>0.5</sub> High Entropy Alloy Coatings Manufactured by Laser Cladding</b> | 335 |
| H. Liang, B.Y. Gao, Y.N. Li, Q.X. Nie and Z.Q. Cao  |     |
| <b>Laser Assisted High Entropy Alloy Coating on Low Carbon Steel</b>  | 341 |
| C.A. Souto, G.F.M. da Silva, L.A.A. Rodriguez, A.C. de Oliveira and K.R. Cardoso  |     |
| <b>In Situ Laser Synthesis of High Entropy Alloy Coating on Ti-6Al-4V Alloy: Characterization of Microstructure and Properties</b>  | 347 |
| Z.B. Cai, X.J. Pang, X.F. Cui, X. Wen, Z. Liu, M.L. Dong, Y. Li and G. Jin  |     |
| <b>AlCoCuFeNi High-Entropy Alloy Coating Fabricated by Laser Cladding with Gas-Atomized Pre-Alloy Powders</b>   | 355 |
| M.N. Zhang, W.T. Ouyang, J.K. Jiao, W.W. Zhang and X.L. Zhou  |     |