Contents

Preface viii
About the Editors ix
List of Contributors xi

Chapter 1 Introduction to Advanced Coating and Cladding Technologies 1

Pankaj Kumar, Manowar Hussain, Mohammad Shahid Raza, and Amit Kumar Jain

Chapter 2 Advanced Coating Systems in High-Temperature Corrosion Protection 41

Mona Obead Albalawi

Chapter 3 From Atom to Abyss: An Anatomical Analysis of Coating Degradation Mechanisms in Extreme Environments and Industrial Solutions 58

Moatassim Raoof

Chapter 4 Laser Cladding for 316L Stainless Steel: Parameter Effects and SYSWELD-Based Process Design 88

Mohammed Zubairuddin, Shahid Tamboli, R. Ravi Kumar, G. R. Joshi, Balram Yelamasetti, and MD. Faseeulla Khan

Chapter 5 Development of Nickel-Based Alloy Coatings and Claddings: Techniques and Advancements 101

Suresh Gudala, Subbarao Medabalimi, Uzwalkiran Rokkala, and Prakash Kumar

Chapter 6 Enhancing Cladding Performance: Chromium Oxide and Alumina Powders with PVA Binder in GTAW Welding 109

Suresh Pratap and Prakash Kumar

Chapter 7 An Overview of Nanocoatings: Performance Enhancement of Heat Exchangers 121

Vikas Kumar and Shiv Lal

Chapter 8 Nanocomposite Biomaterials for Orthopedic Implants: A New Frontier 133

Uzwalkiran Rokkala, Subbarao Medabalimi, Divakar Bommana, N Pallavi Senapati, and T. Rajesh Kumar Dora

Chapter 9 Enhancing Wear Resistance of HVOF-Sprayed Coatings Using Partially Oxidized Powders: Mechanisms, Performance, and Applications 145

Subbarao Medabalimi, Uzwalkiran Rokkala, Prakash Kumar, and Suresh Gudala

Chapter 10 Laser Modification and Al–Ti Coating Effects on AZ31 Wear 155

Tejonidhi G K, Bharatish A, Abhishek R, Varshith K, Vijay Kumar P R, Sivakumar S, Shanmukha N, Rajkumar G R, and Harisha S K

Chapter 11 The Emerald Canopy: Nature's Blueprint for Advanced, Sustainable Coatings in Next-Generation Aerospace and Automotive 171

Moatassim Raoof

Chapter 12 Eco-friendly Corrosion Protection Solutions for Aerospace and Automotive Industries 197

Salman Basha Sheik, Praveena Devi Nagireddy, Kiran Kumar Kupireddi, and Addanki Rama Swamy

Chapter 13 Advanced Green Coating and Inhibitor Technologies for Corrosion Resistance 214

Priya Kesari

Chapter 14 Microstructure Image-Based Machine Learning for Predicting Fatigue and High-Temperature Properties of Titanium Alloys through Additive Manufacturing 239

SD Ruksar Begum, Pankaj Kumar, Pulla Sammaiah, and Ande Rohan

Chapter 15 Next-Generation Surface Engineering: Trends in Coating and Cladding Technologies 260

Bappa Das, Shakti Kumar, Bishub Choudhury, Sumit Kumar Sinha, Arka Ghosh, and Royal Madan

Chapter 16 Dielectric Behavior of $BiVO_4$: Potential Impacts and Applications in Mechanical Engineering Systems 284

Anima Ghosh and Surja Kiran Ghorui

Chapter 17 Challenges and Mitigation Strategies for Chromium-Free Electroless Nickel Plating on as-Printed ABS Surfaces Manufactured by 3D Printing 291

Koustubh Chouhan, Sumanta Mukherjee, and Vikas Kumar

Chapter 18 Predictive Modeling and Optimization of Additive Manufacturing and Laser Cladding Processes Using Machine Learning and Artificial Intelligence 313

Shakti Kumar, Priya Kesari, Bappa Das, Bishub Choudhury, Manowar Hussain, and K. Pavan Chandu

Chapter 19 Predictive Modeling of Electroless Polyalloy Coating Properties Using Artificial Neural Networks 333

Vikash Kumar, Buddhadeb Oraon, and Sumanta Mukherjee

Index 352