

APPLIED METHODOLOGIES FOR MATERIALS PROCESSING AND SIMULATION

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Editors
Nor Akmal Fadil
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CONTENTS

<i>Contributors</i>		<i>vii</i>
<i>Preface</i>		<i>ix</i>
CHAPTER 1	FUNDAMENTAL IN APPLIED METHODOLOGIES FOR MATERIALS PROCESSING AND SIMULATION	1
	<i>Nor Akmal Fadil and Wan Fahmin Faiz Wan Ali</i>	
CHAPTER 2	MITIGATING TIN WHISKERS IN ELECTRONICS VIA ELECTROLESS DEPOSITION	9
	<i>Nor Akmal Fadil, Siti Zahira Yusof, and Saidatul Akmaliah Mior Shahidin</i>	
CHAPTER 3	SINGLE BATH BRASS ELECTROPLATING FOR STEEL CORDS	25
	<i>Muhammad Azizi Mat Yajid, Carmen Wong, and Mohd Salihin Hassin</i>	
CHAPTER 4	COBALT DEPLETION TECHNIQUES FOR TUNGSTEN CARBIDE SUBSTRATES	47
	<i>Tuty Asma Abu Bakar, Izman Sudin, and Engku Mohammad Nazim Engku Abu Bakar</i>	

CHAPTER 5	DEVELOPMENT AND APPLICATION OF NATURAL FIBER POLYMER COMPOSITES	61
	<i>Muhammad Asyraf Muhammad Rizal, Wan Aliff Abdul Saad, Najlaa Nazihah Mas'ood, and Melbi Mahardika</i>	
CHAPTER 6	PHYSICS CONSTRAINED NEURAL NETWORKS FOR THERMAL PREDICTION IN LASER DEPOSITION	79
	<i>Onuchukwu Godwin Chike, Norhayati Ahmad, Mohd Azlan Suhaimi, and Wan Fahmin Faiz Wan Ali</i>	
CHAPTER 7	THERMAL ANALYSIS OF OSCILLATION LASER WELDING FOR DISSIMILAR ALLOYS	103
	<i>Mohd Faridh Zaharuddin and Wenchao Zhang</i>	
INDEX		121

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PREFACE

Materials research has become increasingly interdisciplinary, merging classical experimental techniques with advanced computational tools and sustainable design approaches. This book, *Applied Methodologies for Materials Processing and Simulation*, presents a concise yet diverse collection of methodologies that are foundational to both academic research and industrial practice.

The early chapters focus on deposition techniques related to electroless deposition and electroplating which are widely used for coating, surface modification, and electronic applications. These methods offer accessible, scalable solutions for creating functional surfaces with specific mechanical, electrical, or chemical properties. This is followed by Chemical Vapor Deposition (CVD), a high-precision technique essential for fabricating thin films and coatings in high-performance environments such as semiconductors and aerospace.

Shifting toward bio-based and sustainable materials, the book discusses natural fiber reinforced polymer composites, highlighting their processing, structural advantages, and growing role in lightweight and eco-friendly engineering applications. In the latter chapters, we embrace the digital transformation in materials research. Deep Neural Networks (DNNs) are introduced as powerful tools for pattern recognition, property prediction, and materials informatics which enabling data-driven decisions in material design and process optimization. Finally, Finite Element Modeling (FEM) is presented as a robust simulation method for understanding complex mechanical behavior, validating experimental results, and accelerating material development.

Together, these topics reflect the evolving landscape of materials science—where synthesis, characterization, sustainability, and simulation converge. This book is intended to support students, researchers, and engineers in understanding the key methods that drive innovation in the field today.

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