

Preface

The rapid advancement of materials science continues to expand the possibilities of engineering design, increasing machine durability and optimising production performance. This special edition is dedicated to two significant domains of materials science: polymers and composites, and surface engineering of structural metals. These branches play critical roles in modern industrial, structural, and high-technology applications.

Chapter 1: Composites and Polymers explores the relationships between the structures and properties of polymeric and composite materials engineered to enhance the mechanical, thermal, and chemical performance of final products. The chapter examines synthesis and processing techniques, reinforcement strategies, and interfacial bonding mechanisms that determine composite efficiency. Fiber-reinforced, nanoscale, bio-based, and multifunctional materials are discussed in the context of aerospace, automotive, biomedical, and construction applications. Emphasis is placed on lightweight design, sustainability, recyclability, and reflecting the growing importance of polymers and composites in advanced engineering systems.

Chapter 2: Metal Surface Modification, Coatings and Corrosion Resistance focuses on technologies that enhance the surface properties of metallic components. Since surface degradation, particularly corrosion and wear, are major challenges in engineering systems, surface modification techniques such as thermal spraying, physical and chemical vapour deposition, electrochemical treatments, and other advanced coating technologies are examined in detail. The chapter discusses microstructural evolution, adhesion mechanisms, protective performance, and testing methodologies. Strategies for improving corrosion resistance in aggressive environments are also highlighted.

The presented research results underscore the importance of innovations in these branches in achieving long-term structural integrity, operational reliability, and environmental sustainability.

This edition aims to serve as a valuable reference for researchers, engineers, and graduate students engaged in materials development, encouraging interdisciplinary collaboration and innovation.