

Preface

Materials science and chemical engineering are transformative in advancing industrial technologies and scientific discovery. This special edition contains research results and developments across three domains: joining and casting processes, special and functional materials, and chemical treatment and production processes. These areas underpin modern manufacturing and reflect the interdisciplinary nature of engineering solutions.

Chapter 1: Joining and Casting focuses on the foundational yet evolving techniques for fabricating components and structures in various industries. This chapter covers innovations in welding, adhesive joints, and conditions forming blow-hole defects in casting, emphasising process optimisation, microstructural control, and material compatibility, essential for ensuring product integrity and performance.

Chapter 2: Special and Functional Materials explores the properties of materials engineered for special applications that have unique mechanical, thermal, electrical, or chemical properties. From phase change materials and tungsten materials to metamaterials, this chapter highlights the synergy between material structure and functionality across emerging technologies.

Chapter 3: Chemical Treatment and Chemical Production examines the processes used in the photoconversion of carbon dioxide to methanol, refractory gold extraction from ores, and application of zeolitic-imidazolate frameworks for gas separation applications.

This special edition's primary aim is to provide researchers, practitioners, and graduate students with a coherent view of the latest developments in these fields. We hope this book serves as a reference and a catalyst for further innovation and interdisciplinary collaboration in materials and chemical engineering.