

# Preface

The synergy of advanced materials and technologies is crucial for innovation, driving transformative changes across manufacturing industries and engineering disciplines. This special edition is a comprehensive resource that delves readers into key areas of materials science and engineering, offering both foundational knowledge and insights into effective engineering solutions. Structured across five thematic chapters, the book aims to bridge theory with practice, making it a valuable reference for students, researchers, and professionals alike.

The first chapter examines materials for application in advancing energy storage devices, such as cathodes of high-performance supercapacitors and aluminum-air batteries, which are effective solutions to sustainable energy.

The next chapter offers readers the results of the exploration of modifications of tellurite-based glass for applications as a material for lasers and gamma-ray shielding.

The processes of friction stir welding are known for their ability to produce high-strength joints. The third chapter contains some research results on the application of friction stir welding for aluminum alloy parts joints, which is critically important for many industries ranging from aerospace to automotive.

The following chapter introduces examples of the practical use of computational tools and data-driven methods in materials development and their properties research. Articles from this chapter demonstrate the growing importance of computational approaches in predicting and optimizing materials properties.

The practice of thermal imaging application for crack identification in solar panels, a numerical investigation of enhancing heat transfer efficiency through nanofluid integration for the thermal management system, and the study of the resources needed to establish the ferroalloy production facility in Pakistan are research topics of articles collected in the last chapter.

This special edition will serve as a useful guide and inspire further field exploration and innovation.