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Editorial

Studies in Advanced and Selective Manufacturing Technologies

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Advanced manufacturing technologies are increasingly shaping how engineering systems are designed, optimised, and realised. By enabling complex geometries, tailored material distributions, and controlled microstructural features, modern manufacturing processes have become essential drivers of innovation across sectors such as transportation, aerospace, energy, and tooling. This reprint book focuses on recent advances that illustrate how manufacturing is no longer a downstream activity, but a central design enabler that links materials, geometry, and performance within an integrated engineering framework.

The volume brings together nine peer-reviewed contributions published in Designs, offering a representative overview of current research trends in additive manufacturing, advanced material processing, lattice and cellular design, surface engineering, and selective machining technologies. Rather than addressing these topics in isolation, the collected works emphasise the interdependence between process parameters, material behaviour, and structural architecture in achieving lightweight, high-performance, and application-specific components.

A dominant theme throughout this collection is the role of additive manufacturing (AM) in performance-driven structural design. Recent studies have shown that AM enables unprecedented control over internal architectures and geometric features, allowing designers to tailor energy absorption, stiffness, and failure mechanisms through informed choices of infill strategy, wall thickness, curvature, and material system [1,2]. In both polymer- and metal-based AM, process optimisation has been shown to strongly influence defect formation, density, and microstructural evolution, which in turn govern mechanical response and functional reliability [3–5].

Beyond AM, advanced material processing routes continue to play a critical role in improving mechanical efficiency and multifunctionality. Powder-based fabrication strategies, including novel milling and consolidation approaches, have demonstrated significant potential for enhancing the strength–ductility balance and energy absorption capacity of lightweight composites [6,7]. Similarly, surface engineering and coating technologies remain essential for extending component lifespan and improving resistance to wear, oxidation, and mechanical degradation under demanding operating conditions [8].

Architected materials and structures form another key pillar of this reprint book. Lattice, cellular, and triply periodic minimal surface (TPMS) architectures are increasingly employed to achieve high stiffness-to-weight ratios, controlled deformation behaviour, and multifunctional performance. Prior studies have shown that the effective implementation of such structures depends not only on geometric design, but also on manufacturing constraints, load transfer mechanisms, and failure modes [9,10], reinforcing the need for close integration between design and process selection.

Finally, the continued importance of selective material removal processes is reflected in recent work on non-traditional machining techniques for advanced alloys. Several studies

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investigated processes such as abrasive water jet machining provide viable solutions for materials that are difficult to process using conventional methods, while still allowing acceptable surface integrity and dimensional accuracy when parameters are carefully controlled [11,12].

Overall, this reprint book demonstrates that the most impactful advances in advanced and selective manufacturing arise from a holistic consideration of materials, processes, and structural design. The collected contributions provide valuable insights for researchers and practitioners seeking to translate emerging manufacturing technologies into robust, efficient, and application-driven engineering solutions. It is hoped that this volume will serve both as a reference and as a catalyst for future research in advanced manufacturing and design.

Conflicts of Interest: The author declares no conflict of interest.

List of Contributions:

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