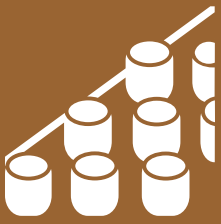

Materials

an Open Access Journal by MDPI

CiteScore: 6.4
Indexed in PubMed
Impact Factor: 3.2

Special Issue Reprint

Recent Advances in Metal Powder Based Additive Manufacturing

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This Special Issue Reprint presents a range of cutting-edge research advancements and scientific developments in metal powder-based additive manufacturing (AM), an ever-evolving field. The works presented here demonstrate significant progress in understanding microstructure–property relationships, process optimization, and novel alloy design. Focusing on the unique characteristics of metal AM techniques such as powder bed fusion and directed energy deposition, the Reprint highlights solutions for manufacturing complex geometries with tailored microstructures. Contributions systematically investigate the interplay between process parameters, thermal history, and resultant mechanical properties across diverse material systems. Key themes include the computational modeling of microstructural evolution, the experimental characterization of defect-formation mechanisms, and innovative approaches for multi-material processing. A particular emphasis is placed on developing high-performance alloys specifically engineered for AM process requirements, ranging from structural steels to advanced materials like high-entropy alloys and bulk metallic glasses. Several papers establish novel frameworks for predicting microstructure development during layer-wise fabrication, providing valuable tools for process parameter selection. By bridging fundamental materials science with practical engineering considerations, this Special Issue Reprint serves as both a reference compendium and catalyst for future innovation.

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