Scanning

Special Issue on

Microstructural Properties of Metallic Alloys Produced by Additive Manufacturing

CALL FOR PAPERS

Additive manufacturing (AM) offers wonderful opportunities to produce lightweight parts with complex shapes, including lattice and porous structures, which is difficult to produce by conventional processes. Selective Laser Melting (SLM), Electron Beam Melting (EBM), and Direct Metal Deposition (DMD) are the main reference AM processes for metals. They are based on local melting of powders by means of a laser or an electron beam. The materials produced by AM form unique microstructures, resulting from the interaction of the beam over the metal powder that leads to high heating and cooling rates, rapid solidification, and large thermal gradients within the melt pools. Microstructures of as-built alloys show evident solidification tracks on the macroscale, whereas they show very fine cellular or dendritic structures decorated at boundaries by solute-rich regions on the microscale. Recently, Binder Jetting (BJ), a new AM technology, is also gaining importance. Layer upon layer, a liquid binding agent is selectively deposited to join powder particles in order to make green parts, which are cured, sintered, and sometimes infiltrated with dissimilar materials, leading to almost fully dense parts with peculiar microstructures.

Advanced scanning tools including scanning electron microscopy (SEM), transmission electron microscopy (TEM), atom probe tomography (APT), scanning probe microscopy (SPM), and confocal laser scanning microscopy (CLSM) are necessary for investigating surface morphology, microstructure, and chemical and crystallographic properties of AM parts before and after postprocessing operations, such as heat treatments (stress reliving, aging, quenching, tempering, etc.) or surface finishing (abrasive blasting, shot peening, etching, etc.).

Characterization and control of microstructures constitute a necessary step to design innovative materials with enhanced mechanical and functional properties, elucidate the effects of process parameters, understand the formation mechanism of defects, and study the precipitation sequences and formation of second phases. Characterization of microstructure and surface of functional and structural components is an unavoidable step for understanding the correlation between process and properties, improving performance, and guiding novel developments in material science and engineering.

The aim of this special issue is to publish high-standard research papers and comprehensive reviews addressing innovative and state-of-the-art topics related to the microstructure and surface characterization of AM alloys. Analytic scanning techniques and novel applications of the microscopies in design and development of AM materials with improved performances are especially welcome.

Potential topics include but are not limited to the following:

- Scanning techniques for characterization of multiple material components and devices
- Advancements in scanning techniques for characterization of AM alloys
- Microstructure characterization of novel material formulations and composite materials by scanning electron microscopy
- Microstructure properties of micro-AM parts studied by scanning electron microscopy and transmission electron microscopy
- Transmission electron microscopy to study the effect of microstructure on magnetic and functional properties of AM components
- Scanning techniques for characterization of steels or lightweight alloys produced by AM for structural applications
- Transmission electron microscopy to study the effect of cellular structure and aging on properties of AM alloys
- Correlations between surface, microstructure, and corrosion behavior of AM parts by using confocal laser scanning microscopy or scanning probe microscopy
- Scanning techniques for correlating surface finishing and properties of AM parts
- Scanning techniques for studying the effect of heat treatments on microstructure of as-built alloys

Authors can submit their manuscripts through the Manuscript Tracking System at https://mts.hindawi.com/submit/journals/scanning/mpmp/.

Papers are published upon acceptance, regardless of the Special Issue publication date.

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