

Special Section on Micro- and Nano-Additive Manufacturing—Part 1

Products with micro- and nano-scale features find widespread applications in industries including medical, automotive, optics, electronics, energy, and biotechnology sectors. The tendency toward miniaturization and development of products in many industries exposed the limitations of established micro- and nano-manufacturing methods in terms of processing capability, speed, flexibility, accuracy, scalability, etc. To respond to these challenges, many micro- and nano-additive manufacturing technologies have been developed. Compared to traditional micro/nanofabrication methods, additive manufacturing (AM) has the merits of simpler processing, shorter fabrication time, lower cost, and capability of fabricating high aspect ratio structures and almost any complicated freeform structures. The innovation of novel AM or hybrid processes for micro/nanofabrication is a field of active research throughout the world. Accordingly, characterization, control, modeling, and simulation of the manufacturing process are in great need for achieving accurate and reliable production of micro/nanoscale features. In addition, successful production of complicated features at micro- or nano-scale requires understanding of the materials used as feedstock and the relationships between feedstock materials, designs, processes, and properties of fabricated micro/nanoscale structures. Analysis of the micro/nano-AM process performance, in terms of manufacturing flexibility, reliability, cost, and quality, is also critical to enable more applications in fields including biomedical, mechanical, sensing and actuating industries, etc.

To advance research in the above areas, the micro- and nano-additive manufacturing symposium was initiated at the 2017 ASME Manufacturing Science and Engineering Conference (MSEC) held in Los Angeles, CA. This Special Section Issue of the *ASME Journal of Micro- and Nano-Manufacturing* publishes peer-reviewed research papers from presentations given at the symposium.

Guo et al. presented a microscale three-dimensional (3D) printing process using near-field melt electrospinning. Various 3D thin-wall structures with a minimal wall thickness less than 5 μm were successfully printed. Ultrafine poly (ϵ -caprolactone) (PCL)

fibers have been stably generated and precisely printed into 3D thin-wall structures with an aspect ratio of more than 60. Pan et al. studied the mixing characteristics of dry electrode micro/nanopowder materials in the dry spray additive manufacturing process, through discrete element method (DEM) simulation. A DEM model based on the adhesive interactions of the Li-ion battery electrode particles was developed. Cullinan et al. presented a computational analysis of plasmonic effects in 3D nanoparticle packings using 532 nm plane wave light. They showed that solutions of Maxwell's equation in frequency domain can be used to analyze near-field interactions for nanoparticle sintering in 3D nanoparticle packings. Lan demonstrated an active mixing nozzle and integrated it with electrohydrodynamic jet printing. The developed technique is capable of fabricating multifunctional heterogeneously structured objects with macroscale external geometry and microscale internal structures. Yong et al. explored a multiscale stereolithography process by dynamically changing the shape and size of a laser beam using small apertures with micro-pattern features. The developed process is capable of optimizing the fabrication speed, feature resolution, and scalability simultaneously. Chiarot et al. characterized the structure of nanoparticle deposits printed using electrospray for short spray times. This study provides insight into the physics governing the electrospray deposition process.

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