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Additive Technologies

Additive Manufacturing of Functional and Energy Materials

Additive manufacturing (AM) is a popular choice to fabricate complex designs, such as porous structures, and also for reducing the material waste during the fabrication step. AM also offers the unique capability to control the nano, micro, and macrostructure of a material, thus enabling the user to control the material properties. All of these attributes make AM a potential candidate for functional and energy (F&E) materials.

Functional materials such as shape memory alloys, magnetic shape memory alloys, and piezoelectric materials are sensitive to the macro and microstructure of the material. Recent work in the area of shape memory alloys has demonstrated improved superelasticity in additively manufactured Nitinol without the need for postprocess heat treatment. Similarly, novel architectures for Lithium batteries fabricated using AM showed an improved performance compared to traditional batteries owing to the inherent porosity in the AM structures. Based on these prior studies, it is reasonable to conclude that a detailed understanding of the process-structure-property relationships in F&E materials can open up tremendous opportunities to fabricate materials using AM, with applications ranging from medical to defense to energy industries. These developments unique to AM require a detailed understanding of (i) identifying the optimized architecture/microstructure and (ii) achieving optimized structures via AM.

The goal of this symposium is to provide a platform to discuss ongoing efforts in using AM for F&E materials. Topics of interest include:

- Use of nano-micro-macro scale metal AM processes for F&E materials
- Process-structure-property relationships
- Strategies for design and microstructure optimization using AM
- Modeling of process, microstructure and properties of AM of F&E materials.

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