Evaluations of Additively Manufactured Superalloy Lattice Blocks

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Abstract

Cast lattice block structures made up of high-temperature superalloys were previously shown to offer advantages in density, efficiency, and tailored properties. However, inconsistencies in casting die-fill, composition, and microstructure were identified as persistent issues with the casting process path. Three candidate lattice designs were screened through additive manufacturing of a superalloy. Laser powder bed fusion was applied with superalloy powder to produce lattice blocks for three-dimensional octahedral unit-cell designs of three heights. Properties of the structural designs versus additively manufactured lattices were compared, including structural dimensions, densities, defects, grain structures, crystallographic texture, and surface residual stresses. Findings indicate this concept could produce useful superalloy structures for high-temperature-capable static components requiring tailored density, and thermophysical and mechanical properties.