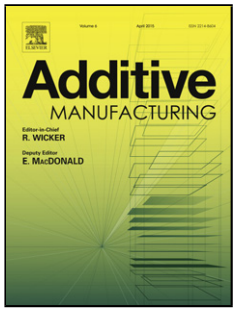

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High-stiffness and strength porous maraging steel via topology optimization and selective laser melting

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Abstract

Recent additive manufacturing technologies can be used to fabricate porous metals with precise internal pore structures and effective performance. We use topology optimization to derive an optimal pore structure shape with high stiffness that is verified experimentally. The design maximizes the effective bulk modulus and isotropic stiffness, and the performance is compared with Hashin-Shtrikman (HS) bounds. The optimized structure is fabricated via selective laser melting of maraging steel, which is a high-strength, iron-nickel steel that cannot easily be made porous with conventional methods. The optimal porous structure achieved 85% of the performance of the HS upper bound in numerical simulations, and at least 90% of them were realized in compressive testing. Finally, the performance is discussed relative to that of

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