A New Strategy for Metal Additive Manufacturing Using Economical As-Atomized Steel Powders

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Abstract

Current methods of using water-atomized powders in additive manufacturing (AM) typically require post-atomization annealing to adjust carbon and oxygen content, which is both time-consuming and energy-intensive. This study explores a streamlined approach by designing a high-carbon AISI-4340 steel composition and directly utilizing these powders in their as-water-atomized state for binder jetting additive manufacturing (BJAM). The ability of these powders to form complex, high-density geometries with thin walls and overhang structures was demonstrated. The effect of densification on pore morphology was investigated using micro X-ray tomography and computer vision-based 3D reconstruction. Micro x-ray tomography and computer vision-based 3D reconstruction were employed to analyze pore morphology, with future work aimed at benchmarking against traditional powder metallurgy (PM) steels.