Investigation of Mechanical Properties of Parts Fabricated with Gas- and Water-Atomized 304L Stainless Steel Powder in the Laser Powder Bed Fusion Process

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Abstract

The use of gas-atomized powder as the feedstock material for the Laser Powder Bed Fusion (LPBF) process is common in the Additive Manufacturing (AM) community. Although gas-atomization produces powder with high sphericity, its relatively expensive production cost is a downside for application in AM processes. Water atomization of powder may overcome this limitation due to its low-cost relative to the gas-atomization process. In this work, gas- and water-atomized 304L stainless steel powders were morphologically characterized through Scanning Electron Microscopy (SEM). The water-atomized powder had a wider particle size distribution and exhibited less sphericity. Measuring powder flowability using the Revolution Powder Analyzer (RPA) indicated that the water-atomized powder had less flowability than the gas-atomized powder. Through examining the mechanical properties of LPBF fabricated parts using tensile tests, the gas-atomized powder had significantly higher yield tensile strength and elongation than the water-atomized powder, however, their ultimate tensile strengths were not significantly different.

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