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# The Effects of Shell Printing On the 316L Stainless Steel Fabricated By Binder Jetting

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## Abstract

Additive manufacturing (AM) is a novel technique for producing metallic materials with complicated shapes and designs. Other than powder bed fusion, binder jetting (BJ) is also one of the AM processes for metallic materials. The main objective of this study was to investigate the influences of shell printing on the microstructure and mechanical properties of BJ 316L stainless steel. The roles of building direction (0°, 45°, and 90°) were also studied to clarify the anisotropy in the microstructure and mechanical performances. The microstructural features were analyzed using optical microscope, scanning electron microscope, energy dispersive spectroscopy, and electron backscatter diffraction. The results showed that after 1380 ℃ sintering, the BJ 316L consisted of austenite and minor delta ferrite. Moreover, after 1380 ℃ sintering, the sintered densities of BJ 316L fabricated by shell printing were 7.87~7.90 $cm^3$. The building direction did not apparently affect the sintered density and tensile properties. The ultimate tensile strength and elongation after fracture ranged from 532 MPa to 557 MPa and from 83 % to 90 %, respectively. These findings indicated that the 316L with high tensile properties and low anisotropic mechanical performance can be produced by the shell printing of BJ technique.

**Keywords:** binder jetting; stainless steel; sintering; microstructure; tensile properties