Thesis Defense

A Comparative Analysis of Microstructural Characterization and Mechanical Performance of SS316L Metal Specimens Fabricated by DED and FDM Techniques

Mitchell Keomoungkhoune

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Abstract

SS 316L is a low carbon alloy well known for its high corrosion resistance and strength as well as its desirable levels of ductility and thermal properties. The introduction of AM (additive manufacturing) processes on the production of SS 316L components has allowed for the fabrication of more geometrically complex optimized shapes and high-level performing parts. This paper will primarily focus on two AM techniques: directed energy deposition (DED) and fused deposition modeling (FDM). Each AM technique was used to fabricate SS 316L metallographic samples, and a comparative analysis was conducted between both methods based on microstructural characterization and mechanical properties of the test specimens. There are some studies conducted on the assessment of the mechanical properties and microstructural characterization of FDM and DED fabricated SS 316L parts, many of which primarily focus on optimized printing parameter to produce high quality SS 316L parts. However, based on currently available literature review there is minimal studies on the comparison of DED and FDM techniques using SS 316L material. The efficacy of SS 316L test specimens fabricated by DED and FDM AM techniques were based on the following performance measures or tests: microhardness, compression properties, density, and microstructure. This paper evaluates the performance of SS 316L material based on mechanical properties and microstructural characterization fabricated by both DED and FDM printing methods. Results indicated that DED fabricated SS 316L parts had higher compressive strength and microhardness to that of FDM built SS 316L likely a result of containing smaller average grain size. However, both AM processes produced samples with similar density and phase composition.