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Additive Manufacturing Thermal Performance Testing of Single Channel GRCop-84 SLM Components

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Abstract

The surface finish found on components manufactured by sinter laser manufacturing (SLM) is rougher (0.013 – 0.0006 inches) than parts made using traditional fabrication methods. Internal features and passages built into SLM components do not readily allow for roughness reduction processes. Alternatively, engineering literature suggests that the roughness of a surface can enhance thermal performance within a pressure drop regime. To further investigate the thermal performance of SLM fabricated pieces, several GRCop-84 SLM single channel components were tested using a thermal conduction rig at MSFC. A 20 kW power source running at 25% duty cycle and 25% power level applied heat to each component while varying water flow rates between 2.1 – 6.2 gallons/min (GPM) at a supply pressure of 550 to 700 psi. Each test was allowed to reach quasi-steady state conditions where pressure, temperature, and thermal imaging data were recorded. Presented in this work are the heat transfer responses compared to a traditional machined OHFC Copper test section. An analytical thermal model was constructed to anchor theoretical models with the empirical data.