# Laser Power and Surface Thickness Analysis of Distortion Within Directed Energy Deposited In-718 Flanges

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**Abstract**

Laser metal deposition (LMD) falls into the directed energy deposition (DED) category of additive manufacturing (AM), and is a blown powder method of the process. With the developments that have been made within AM industries and disciplines, more efficient methods of manufacture are being explored utilising the cost and time saving benefits of the near net shape technology. Nickle based super alloys, known for their excellent oxidation, corrosion, fatigue and creep resistance are becoming widely used in applications of AM constructed jet engine casings, nuclear reactors, the petrochemical industry and turbine blades/components [1, 2]. Within the remit of AM however there is still a requirement to assess components produced for quality control, ensuring that they mirror the designs laid out in the planning stages of production. The production of 3D component parts manufactured using LMD has led to new challenges however, resulting in large knowledge gaps in the mechanical and microstructural properties of the components being produced. Thus, bringing into question part durability and reproducibility. This study will investigate the effectiveness of building net shape thin walled cylindrical parts from Inconel-718, and what the effects of laser power and wall thickness have on the geometrical accuracy and material properties. To measure distortion seen through the application of a flange onto a cylinder, optical metrology will be used. Properties of the deposited flange will be investigated using X-ray computerised tomography (XCT) and optical microscopy showing how the laser power effects the lamination of deposited layers. Artefacts have been produced using a Trumph DMD 505, 2kW CO2 laser driven LMD machine.

Keywords: Laser metal deposition; additive manufacturing; mechanical properties

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