



Contribution ID: 53

Type: **Poster Presentation**

Fabrication of Functionally Gradient Material Components of AISI 316L and Inconel 718 using Laser Powder – Directed Energy Deposition.

Laser Powder-Directed Energy Deposition (LP-DED) can be used to produce Functionally Gradient Materials (FGM) by gradually changing the composition fed into the melt pool. FGM components find many applications in various industrial fields as they are characterized by different functional performances along the part. The deposition of FGM components using AISI 316L/Inconel 718 via LP-DED is very attractive thanks to the combination of high temperatures, mechanical properties, and resistance corrosion of the Inconel 718 with the resistance corrosion, lower density, and easy machinability of the AISI 316L. However, it has presented challenges due to the many complex phenomena that arise when the different compositions interact in the molten state. Segregations and cracks produced by carbide formation, and intermetallic phases are in fact frequently reported in the literature. The differences in physical-chemical properties, cooling rate, and coefficient thermal expansion of these materials also cause process instabilities. This research presents a methodology to produce FGM samples combining AISI 316L with Inconel 718 reducing the instability of the melt pool. The methodology used includes the powder characterization, the adjustment of the process parameters, and the fabrication of three samples: one of 100% AISI 316L, one of 100% Inconel 718, and one FGM sample with a continuous transition 100% AISI 316L, 50% AISI 316L, 50% Inconel 718, and then 100% Inconel 718 using a powder feeder. The sample characterization included the porosity along the build direction, the microstructure, the phase content by X-ray diffraction, and the microhardness. The results obtained revealed that all samples have a porosity level below 0.3%, the transition of the chemical composition was as expected, and secondary phases were not observed; the microhardness obtained was 225 HV for the AISI 316L, 243 HV for the transition zone, and 290 HV for the Inconel 718.

Keywords: Functionally gradient Materials, Inconel 718, AISI 316L, Directed Energy Deposition, interface.

Speaker Country

Italy

Primary authors: WONG, Vincent (DISAT, Department of Applied Science and Technology, Politecnico di Torino.); Prof. AVERSA, Alberta (DISAT, Department of Applied Science and Technology, Politecnico di Torino.); Prof. RODRIGUES, Alessandro (Department of Mechanical Engineering, São Carlos School of Engineering, University of São Paulo,)

Presenter: WONG, Vincent (DISAT, Department of Applied Science and Technology, Politecnico di Torino.)

Track Classification: Laser Melting, Electron Beam Melting & Direct Energy Deposition Processes