3D Multi-Material Laser Powder Bed Fusion: a disruptive approach to design/manufacture unparalleled multi-functional solutions

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Abstract

Engineering has been so far a mono-dimension tool where components are mono-material, dense unoptimized and designed for one or two requirements, due to processes' limitations. Traditional components diverge entirely from lightweight and multi-material nature structures endowed with a high level of multi-functionality. To create and developed superior engineering solutions, advanced manufacturing technologies are necessary to evolve from mono-material to multi-material components, from limited geometries to almost any geometry. This works exploits a disruptive home-made 3D Multi-Material-Laser-Powder-Bed-Fusion (3DLPBF) equipment developed at CMEMS (Center for Microelectromechanical Systems) at the University of Minho (Portugal). By allowing materials transitions in three dimensions, this technology aims to bring to life components that provide different functions/properties in a single component, printed at once. Several pairs of materials have been investigated with potential for very distinct industries as medical, aerospace, molds and others. Multi-material Ti6Al4V-CoCrMo, Ti6Al4V-Zr, Ti6Al4V-Ag, 420SS-Cu, Ti6Al4V-CuNi2SiCr and Inconel 718-Cu have been produced by using this technology and later characterized from mechanical, morphological, metallurgical and thermal points of view.

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