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Microstructural and Mechanical Property Investigation on SS316L-Cu Graded Deposition Prepared using Wire Arc Additive Manufacturing

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Abstract : Fabrication of steel and copper-based functionally graded material (FGM) through cold metal transfer-based wire arc additive manufacturing is a novel exploration. Components combining Cu and steel show significant usage in many industrial applications as they combine high corrosion resistance, ductility, thermal conductivity, and wear resistance to excellent mechanical properties. Joining steel and copper is challenging due to the mismatch in their thermo-mechanical properties. In this experiment, a functionally graded material (FGM) structure of pure copper (Cu) and 316L stainless steel (SS) was successfully developed using cold metal transfer-based wire arc additive manufacturing (CMT-WAAM). The interface of the fabricated samples was characterized under optical microscopy, field emission scanning electron microscopy, and X-ray diffraction techniques. Detailed EBSD and TEM analysis was performed to analyze the grain orientation, strain distribution, grain boundary misorientations, and formation of metastable and intermetallic phases. Mechanical characteristics of deposits was also analyzed using tensile and wear testing. This works paves the way to use CMT-WAAM to fabricate steel/copper FGMs.

Keywords : wire arc additive manufacturing (waam), cold metal transfer (cmt), metals and alloys, mechanical properties, characterization
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