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The corrosion behavior of 316L stainless steel additively manufactured by direct energy deposition process

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Abstracts: Traditional additive manufacturing (AM) technologies tend to focus on powder bed fusion (PBF) methods such as SLM (Selective Laser Melting) and EBM (Electron Beam Melting), that are attractive for the rapid production of complex components. However, their inherent drawbacks include high cost of powders, high energy consumption and size limitation. Hence, more affordable and flexible direct energy deposition processes such as wire arc additive manufacturing (WAAM) are gaining increased interest. This study aims to evaluate the corrosion behavior including stress corrosion resistance of 316L stainless steel produced by the WAAM process. Experimental samples in the form of cylindrical rods were produced by WAAM process using 316L stainless steel wires and compared with its counterpart AISI 316L alloy. The corrosion resistance was evaluate using potentiodynamic polarization, impedance spectroscopy and slow strain rate testing (SSRT). Despite the differences between the microstructures of printed WAAM 316L alloy and its counterpart AISI 316L, the corrosion performance of both alloys in 3.5% NaCl solution was quite similar.

Keywords: additive manufacturing; direct energy deposition; wire arc additive manufacturing; 316L stain-less steel; stress corrosion