Corrosion Properties of Inconel 625 Processed by Laser-Powder Bed Fusion

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Abstract

Inconel 625 (IN625) is a nickel-based superalloy, which is known for its high mechanical strength, high temperature resistance, and excellent corrosion resistance. These properties make IN625 ideal for use in extreme environments such as those encountered in marine or space applications. However, IN625 is difficult to fabricate via traditional reductive manufacturing methods owing to high tool wear and low removal rate. The fabrication of IN625 parts via laser-powder bed fusion (L-PBF) has been reported, but little is known about the relationship between various process parameters and the corrosion properties of the resulting part. In this study, two nondestructive techniques based on alternating current frequency response analysis – electrochemical impedance spectroscopy (EIS) and electrochemical frequency modulation (EFM) – were employed to determine parameters including polarization resistance, Tafel constants, and corrosion current for L-PBF IN625 specimens under various process conditions. Furthermore, microstructural properties of the specimens were analyzed via electron microscopy (SEM) and x-ray diffraction (XRD) to understand property-microstructure relationships.

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