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Abstract

Microbial-Induced Corrosion of 3D-Printed Stainless Steels: A Surface Science Investigation †

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Abstract: Stainless steel is a material manufactured for its high corrosive resistance and is the first choice of material in a range of applications. Microbial-induced corrosion can cause significant damage to metals and is responsible for approximately 20% of corrosive damage. The corrosive resistance of stainless steel is reduced during manufacturing processes, including welding or joining methods, as the connection points prevent the metal from reforming its passivation layer. Additive manufacturing processes allow for intricate designs to be produced without the need for welding or bolts. However, it is unknown how the layering method of additive manufacturing (AM) will affect stainless steel's passivation layer and, in turn, its corrosive resistance. This research compares the corrosive resistance of 316L stainless steel produced using laser metal deposition and traditionally manufactured AISI 316 stainless steel to determine how the layering manufacturing method affects the corrosive resistance of the material. Samples are incubated over a 21-day period with Acidithiobacillus ferrooxidans (A.*f*) and Leptospirillum ferooxidans (L.*f*) in a modified HH medium with an approximate pH of 1.8 and kept at a constant temperature of 30 °C. Scanning electron microscopy and Auger electron spectroscopy surface analysis techniques are used to identify any corrosive processes on the surface of the samples. This research is an introductory analysis of the corrosive resistance of AM 316 stainless steel using the laser metal deposition technique. The results show how stainless steel produced using laser metal deposition will react in acidic environments and are used to determine if it could be used in conjunction with other materials in underground pipes for acidic soils.

Keywords: 3D metal printing; corrosion; biocorrosion; stainless steel 316L; scanning electron microscopy; scanning Auger nanoprobe

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