Corrosion behavior of additively manufactured 316L stainless steel in acidic media

ZHIJUN ZHENG[1]

[1] *South China University of Technology, China PR*

Abstract: Additive manufacturing has recently begun to emerge as an important commercial manufacturing technology due to directly fabricate and repair complex metallic components that reduce the processing time and costs compared with traditional methods. However, the corrosion behavior of additively manufactured (AM) alloys has been sparsely studied and very little work has been published so far. Corrosion will remain an important aspect needed to be treated for AM alloys. Therefore further research in terms of microstructure characterization and corrosion testing is required. Thus, the objective of this work is to study the corrosion response of AM 316L stainless steel (SS) in acidic solutions. The wrought counterpart was used to make the comparison. Firstly, the AM 316L SS specimen was produced using an AM-250 unit with a powder particle size in the range of 15-50 um. The microstructure of AM 316L SS was characterized by utilizing EDS, XRD, SEM instruments. The chemical composition and fine microstructure of the passive film on AM 316L SS and wrought counterpart in acidic solution were characterized by XPS. The corrosion behaviors of the passive film on two kinds of specimens were evaluated by electrochemical analysis. The dependence for the occurrence of faradic and non-faradic reactions on the nature of the passive film was investigated by EIS. The corrosion current density (i_{corr}) and breakdown potential of passive film on specimens was revealed by cyclic polarization tests. Finally, the integrated barrier characteristics of AM SS in acidic solution was evaluated and compared with the counterpart.

Keywords: Additive manufacturing, 316L stainless steel, acidic environment, corrosion behavior.