Hybrid heat-source solid-state additive manufacturing of 5A06 deposition with favorable mechanical and electrochemical performance

Qian Qiao[1], X. Chen[1,2], W.I. Lam[1,2,3], Y. Lin[4], H. Wang[4], H. Qian[5], Z. Li[5], D. Guo[*1,2,3], D. Zhang[5], C.T. Kwok[3], L.M. Tam[*1,2,3]

[1] *IDQ Science and Technology Development (Hengqin, Guangdong) Co. Ltd., Guangdong, China*
[2] *Institute for the Development and Quality, Macao, China*
[3] *Department of Electromechanical Engineering, University of Macau, Macao, China*
[4] *Aerospace Engineering Equipment (Suzhou) Co. Ltd., Suzhou, China*

[5] *National Materials Corrosion and Protection Data Center, Institute for Advanced Materials and Technology, University of Science and Technology Beijing, Beijing, China*

Presenter's e-mail address: qiaoqian19961210@gmail.com

Abstract

The HHSAMed 5A06 deposition, fabricated via hybrid heat-source solid-state additive manufacturing (HHSAM), exhibits a more homogeneous microstructure with elevated microhardness (89.9 HV0.5), yield strength (238.3/184.0 MPa), ultimate tensile strength (358.1/324.5 MPa) and elongation of 27.5%/15.7%, respectively. The heat-source enhances the material flow behavior and the interlayer bonding strength among the stacking layers, excluding the effects of grain refinement and precipitate strengthening. It demonstrates superior corrosion resistance relative to the AFSD deposition and 5A06 feedstock, attributed to the most stable passive film, a greater concentration of $Al_6(Fe,Mn)$ and the lack of Al_3Mg_2.

Keywords Additive friction stir deposition (AFSD); hybrid heat-source solid-state additive manufacturing; in-situ monitoring; mechanical properties; electrochemical behaviors