Microstructure and Corrosion performance of Inconel 718 manufactured by selective laser melting

Mengyan NIE[1], Xiao ZHAO[2], Kwang-leong CHOY[3], Sirapat WATTANAMANONT[3], Kaize TENG[3]

[1] University College London, United Kingdom
[2] Faculty of Engineering and Physical Sciences, University of Southampton, United Kingdom
[3] Institute for Materials Discovery, University College London, United Kingdom

Nickel-based superalloy 718 (Inconel 718) samples were manufactured using selective laser melting (SLM) technology with different laser power in the range of 260 W to 340 W. Microstructure of the SLMed 718 alloy samples were characterized with optical microscopy (OM) and scanning electron microscopy (SEM). Electrochemical techniques, including open-circuit potential (OCP), electrochemical impedance spectroscopy (EIS) and cyclic polarization curve methods, were used to investigate corrosion performance of 718 alloy samples manufactured under different laser powers in 3.5 wt% NaCl aqueous solution. Electrochemical analysis results demonstrated that all the SLM manufactured 718 samples exhibited better corrosion behaviour than conventionally forged sample, with more positive corrosion potentials, lower corrosion rate and greater pitting breakdown potentials. The microstructural analysis results reveal the molten tracks on the surface of the SLMed 718 specimen and cellular structure at higher magnifications. Moreover, an increase of pores size was also observed when the laser power is less or greater than 300W. The trend of corrosion performance with laser power was discussed combined with microstructural changes.