Environmental behaviour of Ti-6Al-4V alloy obtained by additive manufacturing technology

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The attractiveness of additive manufacturing (AM) technology relates to its capability to produce complex components with reduced weight at a relatively short time. The advantage of AM technology and selective laser melting (SLM) process in particular mainly relates to its ability to produce components layer-by-layer using high energy laser and selective fusing process of metallic powder bed. Although Titanium base alloys are considered as favourable material for SLM process, the significantly increased solidification rate associate with this technology results in producing modified microstructure with increased internal stresses that can have a detrimental effect on corrosion performance.

The present study aims at evaluating the environmental behaviour of Ti-6Al-4V alloy produced by SLM in compression with its counterpart wrought alloy with the same chemical composition. Corrosion behaviour measurements in terms of immersion test, cyclic potentiodynamic polarization analysis, impedance spectroscopy (EIS) and stress corrosion by slow strain rate testing (SSRT) were carried out in 3.5%NaCl solution at ambient temperature. The microstructure and internal stresses were evaluated by Scanning Electron Microscopy (SEM) and X-ray diffraction analysis.

The results obtained clearly revealed that the corrosion resistance as well as the stress corrosion endurance in terms of time to failure of the SLM alloy was relatively reduced compared to its counterpart wrought alloy. This was mainly related to the increased formation of α'-phase with martensitic structure and due to the relatively reduced amount of βphase.

Speaker Biography

A Leon is PhD student in materials science and engineering faculty at Ben Gurion University of the Negev in Israel. Since 2014 his main research work is on the environmental behaviour and properties of light alloys produced by Additive Manufacturing (AM). Moreover, his research interest includes developing of new biodegradable alloys.

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