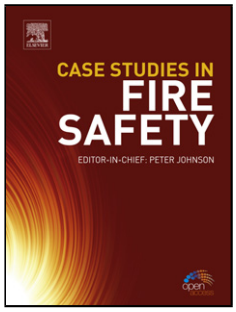

Title: On the corrosion of additively manufactured aluminium alloy AA2024 prepared by selective laser melting

Authors: O. Gharbi, D. Jiang, D.R. Feenstra, S.K. Kairy, Y. Wu, C.R. Hutchinson, N. Birbilis

PII: S0010-938X(18)30824-2
DOI: https://doi.org/10.1016/j.corsci.2018.08.019
Reference: CS 7655

To appear in:

Received date: 8-5-2018
Revised date: 31-7-2018
Accepted date: 6-8-2018

Please cite this article as: Gharbi O, Jiang D, Feenstra DR, Kairy SK, Wu Y, Hutchinson CR, Birbilis N, On the corrosion of additively manufactured aluminium alloy AA2024 prepared by selective laser melting, *Corrosion Science* (2018), https://doi.org/10.1016/j.corsci.2018.08.019

On the corrosion of additively manufactured aluminium alloy AA2024 prepared by selective laser melting

O. Gharbi[1], D. Jiang[1,2], D.R. Feenstra[1,2], S.K. Kairy[1], Y. Wu[1], C.R. Hutchinson[1,2], and N. Birbilis[1,2]

[1]*Department of Materials Science and Engineering, Monash University, Victoria, Australia*
[2] *Woodside Innovation Centre, Monash University, Melbourne, 3800, VIC, Australia*

Highlights

- All figures should be in colour

ABSTRACT

The microstructure, corrosion and electrochemical properties of additively manufactured aluminium alloy AA2024 (Al-Cu-Mg) produced by selective laser melting are reported. In-depth microstructural characterisation was conducted to compare the resultant microstructure, including phase identification, size and distribution, against the wrought counterpart of the alloy (AA2024-T3). The prospect of producing net shape Al-alloys *via* additive manufacturing (AM) has the potential to provide cost effective and high specific strength components. It was revealed that the dominant second phase formed in additively manufactured AA2024 (AM2024) was Al_2Cu (θ–phase), in contrast to the typical Al_2CuMg (S-phase) observed in wrought AA2024. The AM2024 also revealed a refined microstructure, whereby the average size of constituent particles did not exceed ~1 μm. Thermodynamic calculations revealed that the preferential formation of θ-phase was influenced by the Si content of AM2024 (0.78 wt. %). Atomic emission spectroelectrochemistry (AESEC) measurements revealed that the dissolution rate of elemental aluminium in the case of AM2024 was ~ 5 times lower than that of AA2024-T3, concomitant with significant lower corrosion rate of AM2024. Anodic polarisation also revealed that AM2024 was capable of forming an appreciable surface oxide relative to AA2024-T3. The findings herein demonstrate the possibilities of additive manufacturing as applied to a high strength aluminium alloy.

Keywords: Aluminium alloys, Additive manufacturing, Corrosion, AA2024, Selective laser melting.