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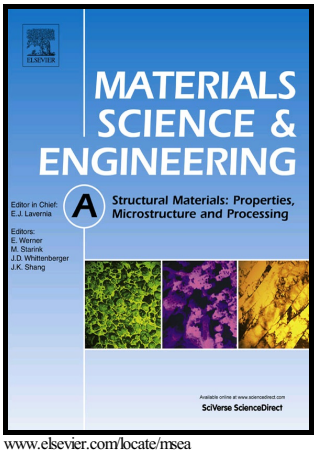

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Strain-controlled iso-thermal fatigue behavior of Co–29Cr–6Mo used for tooling materials in Al die casting

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Abstract

Iso–thermal (IF) fatigue behavior of a single ε-phase Co–Cr–Mo alloy used as Al die casting mold is investigated in details at temperatures of 400, 500, 600, and 700 °C and applied mechanical strains of 0.1%, 0.2%, 0.3% and 0.4%. The results indicate that for a given applied mechanical strain, higher temperature promotes the occurrence of oxidation on alloy surface, resulting in a shorter fatigue life compared to the tests at lower temperature; at a given temperature, larger applied strain amplitude gives rise to shorter fatigue life. Microstructural observation indicates that grain boundary oxidation plays a significant role for crack nucleation at high temperature. The cracks are found to initiate intergranularly and propagate in a mixed intergranular and transgranular mode.

Keywords: Co-Cr-Mo alloy; Thermal fatigue; oxidation; die cast

1. Introduction

Co-based alloys are prospective candidate for replacing the currently used hot-working tools steels as Al die-casting moulds [1-4] due to their excellent resistance to liquid Al and high mechanical strength [5-7]. The high resistance of Co-based alloys