Influence of β-Al5FeSi Intermetallic Area Fraction on the Corrosion Rate of Horizontally Solidified Al-Si-Fe Alloys

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Abstract:

In this study, the corrosion behavior of an Al-7%Si-0.4%Mg-1.2%Fe alloy, obtained through horizontal solidification in a water-cooled device, was evaluated using the mass loss coupon test. The solidification process enabled the characterization of thermal parameters, including growth velocity (VL) and cooling rate (TR), which influence the formation of the β-Al5FeSi intermetallic phase and secondary dendritic spacing (β2). Samples with varying β-Al5FeSi fractions were immersed in sulfuric acid solution, and corrosion rates were determined through mass loss measurements. The results revealed that increased fractions of β-Al5FeSi correlate with higher corrosion rates, highlighting the detrimental effect of this intermetallic phase on the alloy's corrosion resistance. These findings emphasize the critical role of cooling rates and microstructural refinement in reducing the presence of β-Al5FeSi and improving the alloy's performance in corrosive environments.

Keywords:

Corrosion, β-Al5FeSi, Horizontal Solidification, Al-Si-Fe Alloys, Mass Loss Test, Cooling.