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The Effects of Microstructure of Directionally Solidified Al-Si-Fe Alloys on Micro Hardness, Tensile Strength, and Electrical Resistivity

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Abstract : Directional solidification of eutectic alloys attracts considerable attention because of microhardness, tensile strength, and electrical resistivity influenced by eutectic structures. In this research, we examined processing of Al–Si–Fe (Al–11.7wt.%Si–1wt.%Fe) eutectic by directional solidification. The alloy was prepared by vacuum furnace and directionally solidified in Bridgman-type equipment. During the directional solidification process, the growth rates utilized varied from 8.25 m/s to 164.80 m/s. The Al–Si–Fe system showed an eutectic transformation, which resulted in the matrix Al, Si and Al5SiFe plate phases. The eutectic spacing between (λ_Si-λ_Si, λ_(Al_5 SiFe)-λ_(Al_5 SiFe)) was measured. Additionally, the microhardness, tensile strength, and electrical resistivity of the alloy were determined using directionally solidified samples. The effects of growth rates on microhardness, tensile strength, and electrical resistivity for directionally solidified Al–Si–Fe eutectic alloy were investigated, and the relationships between them were experimentally obtained. It was found that the microhardness, tensile strength, and electrical resistivity were affected by both eutectic spacing and the solidification parameter.

Keywords : directional solidification, aluminum alloy, microstructure, electrical properties, tensile test, hardness test
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