Correlation between Microstructure, Thermal Parameters and Hardness of a Directionally Solidified Al-Si-Cu Alloy

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Metals solidification involves the transformation of the molten metal back into the solid state. Solidification structures impact heavily on the final product's characteristics. The microstructure effects on metallic alloys properties have been highlighted in various studies and particularly the dendrite arm spacing influence upon the mechanical properties such as hardness has been reported [1-3]. The aim of this work is to obtain correlations between microstructure and the hardness of Al-10wt%Si-2wt%Cu alloy casting. Initially, the alloy was formed by aluminum, copper and silicon commercially pure, fused in a clay-graphite crucible with an electric muffle furnace. After melting the mixture was poured into stainless steel AISI 304 chill and solidified under upward unsteady state heat flow conditions. Heat was directionally extracted only through a water-cooled bottom made of steel (SAE 1020). The experimental results include solidification thermal parameters such as volume fraction of the eutectic mixture, primary dendritic arm spacing and hardness.It is found that the hardness decreases with the increase of the primary dendritic spacing and with the decrease of the eutectic mixture fraction.

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