The Effect of Direct Thermal Method, Temperature and Time on Microstructure of a Cast Aluminium Alloy

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ABSTRACT

The direct thermal method is used for the creation of globular microstructures suitable for semi-solid metal forming. In this paper both simulation and experimental results using direct thermal method are presented. ProCAST® software was used to estimate temperature distribution inside the aluminium billet. In validation work, molten aluminium A356 was poured into metallic copper tube moulds and cooled down to the semi-solid temperature before being quenched in water at room temperature. The effect of pouring temperatures of 630 °C, 650 °C, 665 °C, 680 °C and holding times of 45 s and 60 s on the microstructure of aluminium A356 alloy were investigated. The simulation results showed that the average temperature rate within the copper mould, from initial pouring temperature to just before quenching, was approximately 1 °C/s. Examination of the solidified microstructures showed that the microstructure was more spherical when lower pouring temperatures and holding periods were used. From the micrographs it was found that the most globular and smallest structures were achieved at processing parameters of 630 °C and 45 s.

KEYWORDS: Aluminium, A356, Direct Thermal Method, Pouring Temperature, Holding Time, Semi-Solid.