Direct Thermal Method Pouring Temperature and Holding Time Effect on Aluminium Alloy 6061 Microstructure

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Abstract:
The microstructure variation of aluminium 6061 billet produce via direct thermal method with different pouring temperature and holding time is presented in this paper. The direct thermal method is one of the techniques used to create globular microstructure feedstock billet which gives the material a thixotropic behaviour during thixofroming. This process causes less superheat to be extracted by the cylindrical copper mould and gives a slow cooling rate action during the solidification stage that promotes the formation of further nuclei, which results in the globular microstructure. This globular microstructure gives a thixotropic behavior improvement in better fluidity for a better flow during shaping. In this experimental work, molten aluminium 6061 was poured into a cylindrical copper mould and hold it before quenched into room temperature water. The pouring temperatures were at 660 °C and 700 °C while the holding times were at the 20s and 60s respectively. The result shows that the combination of a pouring temperature of 660°C with a 20s holding time produces near globular microstructures. The pouring temperature used was just slightly above the liquidus temperature provides slower cooling rates from above to below the liquidus temperature. The result also shows that the combination of a pouring temperature of 660°C with a holding time of 20s produced the smallest grain size. However, the circularity and aspect ratio that indicates globular microstructure has an insignificant change which indicates that every feedstock billet has a near globular microstructure. In conclusion, this work has shown that the globular microstructure feedstock billet was achieved with the pouring temperature of 660°C with holding time of the 20s by using the direct thermal method that suitable for thixoforming operation

Keywords: Direct Thermal Method; Pouring Temperature; Holding Time; Microstructure; Aluminium Alloy 6061;

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