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Microstructure Characteristic of Aluminium 6061 Semi-Solid Feedstock Billet Produced with Direct Thermal Method

***M. F. M. Tajudin*[1], *A. H. Ahmad*[1,2], *J. Alias*[1,2], *N. A. Abd Razak*[1] *and* *N. A. Alang*[3]**

[1]Department of Mechanical Engineering, College of Engineering, Universiti Malaysia Pahang, 25150 Kuantan, Pahang, Malaysia.

[2]Centre for Automotive Engineering, Universiti Malaysia Pahang, 26600 Pekan, Pahang Malaysia.

[3]Structural Performance and Materials Engineering (SUPREME), Faculty of Mechanical and Automotive Engineering Technology, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia.

**Corresponding author:* asnul@ump.edu.my

Abstract

Direct thermal method is one of the semi-solid metal processing technique to produce a globular microstructure feedstock billet for thixoforming. In this experimental work, the molten Aluminium 6061 with a temperature of 660 °C and 680 °C was poured into a thin cylindrical copper mould. The molten Aluminium 6061 was held within the copper mould with a different holding times of 20 s, 40 s and 60 s. The copper mould was quenched into room temperature water after achieving the specified holding duration. After the feedstock billets were removed from the mould, the microstructure formation of the feedstock billets was characterized. It was found that sample 1 which was combination of pouring temperature of 660 °C and holding time of 20 s has the lowest grain size at 2507.87 μm2. The circularity, aspect ratio and ferret diameter was found at 0.75, 1.34 and 69.4 μm, respectively. It was apparent that sample 1 produced finer and globular microstructure. The rapid cooling condition of the molten metal within the copper mould resulted in more globular grain structure. Based on the result, it can be concluded that the microstructure were merely depended on the heat convection between molten alloy and the copper mould. The rapid cooling condition produced smaller and more globular microstructure feestock billet that suitable for thixoforming

Keywords: Semi-solid processing; Globular microstructure;Semi-solid feedstock billet; Aluminium 6061.