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Effects of Rheocasting Time in a Slurry Die Casting Process on Microstructure and Strength of ZA-27 Zinc Alloy

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Extended Abstract

In the recent years, many semi-solid processing methods have been developed for metals and alloys casting industries. Gas Induced Semi-Solid (GISS) process is an efficient semi-solid slurry making technique was recently invented by Wannasin et al. (2006). In the GISS process, fine inert gas bubbles are introduced into the molten metal during solidification, creating a semi-solid slurry containing non-dendritic or globular particles. The GISS technique can be used with the die casting process for casting some non-ferrous alloys such as aluminum, tin, and zinc alloys (Wannasin et al., 2012). The purpose of the present study was to evaluate a possibility of using the GISS technique for die casting of a high strength Zn-Al alloy. The commercial ZA-27 zinc alloy with nominal chemical compositions of 27-28 wt.% Al, 2.0-2.5 wt.% Cu and the remaining Zn, was used in the study. The effects of gas introducing time (i.e. the GISS time or the rheocasting time) in the semi-solid slurry preparation of ZA-27 zinc alloy for the die casting process on the microstructure and tensile strength of the die casting specimens were studied. The nitrogen gas was used and the fine gas bubbles were introduced into the molten zinc alloy through a porous graphite diffuser for 5, 10, and 15 seconds. The longer GISS time was used, the more solid fraction was formed in the slurry. The alloy slurry was cast in an 80-ton die casting machine. The microstructural analysis and tensile tests were performed on the slurry die casting specimens and also on the specimens which were conventionally die cast in the liquid state for comparison purpose. It was found that the tensile strength and the elongation at break of the slurry die casting specimens trended to increase with increasing the GISS time. It was observed that with increasing the GISS time, the more globular structure of the primary Zn-phase particles and less shrinkage pores were formed within the die casting specimens.

Wannasin, J., Martinez, R., & Flemings, M. (2006). Grain Refinement of an Aluminium Alloy by Introducing Gas Bubbles during Solidification. *Scripta Materialia*, 55, 115-118.

Wannasin, J., Thanabumrungkul, S., & Flemings, M. (2012). Semi-Solid Die Casting Using the Gas Induced Semi-Solid (GISS) Technique. *Die Casting Engineer*, 36-40.