

Solid State Phenomena

Semi-solid casting of pure magnesium

CURLE Ulyate A.^{a*} and WILKINS Jeremias D.^b

Light Metals, Materials Science and Manufacturing, Council for Scientific and Industrial Research Pretoria, South Africa

a ucurle@csir.co.za, b jdwilkins@csir.co.za

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Abstract

Semi-solid processing works on the principal of a solidification temperature interval of a substance. The substance is heated to a temperature within this interval so that there exists a related solid-liquid fraction ratio. The substance with this phase structure is then shaped by a forging or casting process. It has been stated before that it is impossible to semi-solid process and cast pure metals or eutectic alloys due to their thermodynamic temperature invariance, meaning that there is no temperature interval. It was demonstrated recently that it is possible to semi-solid casting high purity aluminium (Curle UA, Möller H, Wilkins JD. *Scripta Materialia* 64 (2011) 479-482) and the Al-Si binary eutectic (Curle UA, Möller H, Wilkins JD. *Materials Letters* 65 (2011) 1469-1472). The working principal is that there exists a time interval during thermal arrest during which solidification takes place with a solid-liquid fraction ratio until all the liquid is consumed upon cooling. The aim with this work is to demonstrate that pure magnesium can also be rheo-high pressure die cast (R-HPDC) with the system developed at the CSIR in South Africa. Magnesium is notoriously difficult to cast due to the thermal properties of magnesium. The metal was poured into a cup, processed for about 6 seconds after which it was HPDC into a plate. The microstructure of the casting consists of a structure that was solid and a structure that was liquid during thermal arrest at the time of casting.