

Semi-solid high pressure die casting of metal matrix composites produced by liquid state processing

Lillian Ivanchev^{1a}, Sigqibo Templeton Camagu^{1b} and Gonasagren Govender^{1c}

¹Materials Science and Manufacturing, Council for Scientific and Industrial Research (CSIR), Pretoria, South Africa

Corresponding author: [a_livanch@csir.co.za](mailto:livanch@csir.co.za), [b_scamagu@csir.co.za](mailto:scamagu@csir.co.za), [c_sgovender@csir.co.za](mailto:sgovender@csir.co.za)

Abstract

There are two main technologies for manufacturing of particulate reinforced metal matrix composites (MMC), solid state and liquid state processing. The great challenge of producing cast metal matrix composites is to prevent agglomeration of particulates. This tendency is more pronounced with decreasing the particulate size to fine micro- and nano size. A method for producing MMC was successfully implemented for mixing hybrid, nano and low micron sized, reinforcing particles in an aluminium alloy matrix. The hybrid SiC particles were produced by milling 3 μ m to 5 μ m SiC particles to a particle size range between 2.5 μ m and 150 nm. The hybrid particles were mixed with A356 aluminium alloy under combined magneto-hydrodynamic (MHD) and mechanical stirring. The composite was then transferred to a High Pressure Die Casting (HPDC) machine in the semi-solid state. The micron size particles were found to be predominantly in the intergranular eutectic while the nano-particles were predominantly in the primary α -Al grains. Increased ultimate tensile strength, yield strength and hardness were achieved for the new cast metal matrix hybrid component (MMHC) alloy.