

Reinforcement of 2124 Al alloy with low micron SiC and nano Al₂O₃ via solid-state forming

Zizo Gxowa^{1, a*}, Sigqibo Templeton Camagu^{1, b}, Gonasagren Govender^{1, c}, Manuel Filipe Pereira^{1, d}

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

^aZGxowa@csir.co.za, ^bSCamagu@csir.co.za, ^cSGovender@csir.co.za,

^dMPereira@csir.co.za

Abstract

A powder metallurgical process was used to fabricate Metal Matrix Composites (MMCs). A 2124 aluminium alloy was reinforced with 5 and 10 vol. % of Al₂O₃ (40-70nm) to form Metal Matrix Nano Composites (MMNCs) as well as 10 and 15 vol. % of SiC (1-10 μ m) to fabricate low micron MMCs. It was observed that the nano-sized Al₂O₃ particles were evenly dispersed in the aluminium matrix while a lot of loose SiC particles settled on the grain boundaries in the low micron MMCs. The relative density of all the composites increased due to sintering, however full densification was not achieved. This result was attributed to the hindered motion of dislocations, grains and grain boundaries by reinforcing particles. The 2124-Al/10%-SiC composite was cold extruded and the extruded part fractured. A metallographic evaluation was carried out and it was deduced that the mode of failure was intergranular cracking. Hardness tests performed after sintering indicated that hardness increased with an increase in volume fraction of reinforcement in the matrix. Annealing of the extruded part resulted in a decrease in hardness.