بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأفلام قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

بعض الوثائق

الاصلية تالفة

Ain Shams University
Faculty of Engineering

THE INFLUENCE OF PARTICLE TYPE IN THE ALUMINIUM COMPOSITE MMC / PRODUCED BY CENTRIFUGAL CASTING

A Thesis

Submitted in partial fulfilment of the requirements for the Degree of M. Sc. in Mechanical Engineering

BY

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Mechanical Engineering.

The work included in this thesis was carried out by the author in Laboratories of Design and Production Engineering Department, Ain Shams University.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution.

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SUMMARY

The importance of metal matrix composites (MMCs) has increased, because of their superior mechanical and physical properties and ease of fabrication. In case of particulate metal matrix composites an increase in fracture toughness and related properties can be achieved. This type of composites can be economically fabricated.

In recent years, various processes of liquid metal infiltration techniques such as vacuum infiltration, pressure infiltration, squeeze casting have been applied to produce fiber or particle reinforced composites. In these techniques the reinforcements were in the shape of preforms. It was found that preforms have limitations in their use and their volume fraction. Some techniques based on liquid state causes flotation, settling, segregation of particles and a thick interfacial reaction layer between particles and matrix.

In this work, an experimental technique previously developed was used to produce PMMC by the centrifugal casting process. This was applied to three systems (Al 12Si 2Mg / Al_2O_3,/ Graphite and / Feldspar) with different particle densities 2.6, 2 and 3.2 gm/cm^3. An aluminium alloy rod with a certain length is inserted in a steel capsule on the top of a predetermined amount of loose particles. The steel capsule was inserted in an insulated tube and all the system is heated to the required superheat. After heating the system, the insulated tube containing the steel capsule is mounted on the horizontal shaft to rotate with the required rotational speed. Some process and composite variables were changed, such as melt superheat, rotational speed, radius of rotation and particle size.

Generally, uniform particle distribution in the produced composite was obtained particularly in case of alumina particles. The highest volume fraction of particles occurred in case of composites with feldspar particles. The volume fraction of particles depended on the particle size and infiltration pressure. The higher superheat combined with high powder preheating temperature, coarser

particles with regular shape and higher centrifugal forces were required to achieve full infiltration.

By increasing the melt superheat, infiltration pressure and particle size, the microporosity (pores) nearly disappeared and highest relative density was obtained. The relative density was affected by particle size and density. Zero voids volume fraction and void size were obtained at the far end of the composite rod. Sharp interfaces with no reaction layers and good wetting were obtained in case of the three systems used in this work the infiltration mechanism was greatly influenced by the particle type (particle density related to the matrix density).

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