Available online at www.sciencedirect.com

ScienceDirect

Procedia Manufacturing 20 (2018) 97–105

Procedia MANUFACTURING

www.elsevier.com/locate/procedia

2nd International Conference on Materials Manufacturing and Design Engineering

# Mechanical Characterization and Machining of Squeeze Cast AZ91D/SiC Magnesium based Metal Matrix Composites

I.Balasubramanian[a]* R.Maheswaran[b] V.Manikandan[c] Nilesh Patil[d]

M. Ayyanar Raja[e] Ranganath M Singari[f]

[a]*VV College of Engineering, TamilNadu ,India*
[b]*MEPCO Schlenk Engineering College, TamilNadu India*
[c]*Kalasalingam University, TamilNadu, India*
[d]*Marathwada Institute of Technology, Aurangabad*
[e]*Francis Xavier Engineering College, TamilNadu, India*
[f]*Delhi Technological University, New Delhi, India*

**Abstract**

In the present work composite material is prepared by a combination of two or more constituent's materials using squeeze casting process. Magnesium based metal matrix composites are casted using magnesium alloy reinforced with various volume fractions of silicon carbide particulates. A squeeze casting process has been employed under an inert atmosphere to produce magnesium matrix composites and this process leads to a complete wetting of silicon carbide particulates in the molten magnesium. Further, the synthesized magnesium based metal matrix composites are machined by computer numerically controlled lathe. Surface roughness and Metal Removal Rate of the composites are measured and their variation in performances are studied using orthogonal array, Also the mechanical behavior of the composites are determined and also evaluated by comparing the results with the unreinforced magnesium alloy.


Peer-review under responsibility of the scientific committee of the 2nd International Conference on Materials Manufacturing and Design Engineering.

*Keywords:* Mechanical Characterization; Machining; Squeeze Casting, Metal Matrix Composites

* Corresponding author. Tel.: +91- 4637 271849.
*E-mail address:* balacim06@yahoo.co.in

2351-9789 
Peer-review under responsibility of the scientific committee of the 2nd International Conference on Materials Manufacturing and Design Engineering.
10.1016/j.promfg.2018.02.014

## 1. Introduction

Composites are wonder material with light weight, high strength to weight ratio and stiffness property have come along a long way in replacing the conventional materials like metals, wood etc. Properties of composite have been significantly improved with the introduction of ceramic particles. Composite materials are emerging chiefly in response to unprecedented demands from technology due to rapidly advancing activities in aircrafts, aerospace and automotive industries. These materials have low specific gravity that makes their properties particularly superior in strength and modulus to many traditional engineering materials such as metals. As a result of intensive studies into the fundamental nature of materials and better understanding of their structure property relationship, it has become possible to develop new composite materials with improved physical and mechanical properties. These new materials include high performance composites such as Polymer matrix composites, Ceramic matrix composites and Metal matrix composites [1]. Continuous advancements have led to the use of composite materials in more and more diversified applications. The importance of composites as engineering materials is reflected by the fact that out of over 1600 engineering materials available in the market today more than 200 are composite [2]. They show high hardness and they lead to intensive abrasive wear in cutting tool during machining. Metal Matrix Composites (MMC's) have evoked a keen interest in recent times for potential applications. Metal Matrix Composites have very light weight, high strength, and stiffness and exhibit greater resistance to corrosion, oxidation and wear.

Metal-matrix composites (MMCs) are fabricated by any one of the melt-stirring technique. This new edition has been greatly enlarged and updated to provide both scientists and engineers with a clear and comprehensive understanding of composite materials. In describing both theoretical and practical aspects of their production, properties and usage, the book crosses the borders of many disciplines. Fatigue resistance is an especially important property of Magnesium based metal matrix composites (Mg-MMC), which is essential for automotive application. Because their superior properties such as light weight, low density, high strength to weight ratio, high hardness, high temperature and thermal shock resistance, superior wear and corrosive resistance, high specific modulus, high fatigue strength has been improved, so in the present work the Mg-MMCs are fabricated by squeeze casting and their property and their machinability performances are studied.

## 2. Literature Review

A. Dey and K. M. Pandey (2015), made a research on Magnesium matrix composites are potential materials for various applications of aero- space and defense organizations due to their low density, good mechanical and physical prop- reties. The improvement of specific strength, stiffness, damping behavior, wear behavior, creep and fatigue properties are significantly influenced by the addition of reinforcing elements into the metallic matrix compared with the conventional engineering materials. This paper presents the overview on the effects of different reinforcements in magnesium and its alloy, high- lighting their merits and demerits [3]. S. Aravindan et. al. (2015), made a research on magnesium alloy (AZ91D) composites reinforced with silicon carbide particle with different volume percentage were fabricated by two step stir casting process. The effects of changes in particle size and volume fraction of sic particles on physical and mechanical properties of composites were evaluated under as cast and heat treat (T6) conditions. The experimental results were compared with the standard properties. Distribution of particles and fractured surface were studied through SEM images [4].

B. R. Sunil al (2015) made a research on Surface metal matrix composites (MMCs) are a group of modern engineered materials where the surface of the material is modified by dispersing secondary phase in the form of particles or fibers and the core of the material experience no change in chemical composition and structure. The potential applications of the surface MMCs can be found in automotive, aerospace, biomedical and power industries. Recently, friction stir processing (FSP) technique has been gaining wide popularity in producing surface composites in solid state itself. Magnesium and its alloys being difficult to process metals also have been successfully processed by FSP to fabricate surface MMCs [5]. M. Mounib et. al (2013) made a research on Performances of metal matrix composites (MMCs) rely strongly on the distribution of particles within the metal matrix but also on the chemical reaction which may occur at the liquid-solid interfaces. This paper presents the chemical reaction between aluminium based particles Al2O3 and $Al_2O_3$-AlOOH with magnesium alloys matrixes AZ91 and EL21, respectively, and studies the microstructure of these reinforced composites. Different methods such as transmission electron