Sathishkumar et al. 2019. *Int. J. Vehicle Structures & Systems*, 11(3), 273-276
ISSN: 0975-3060 (Print), 0975-3540 (Online)
doi: 10.4273/ijvss.11.3.10

International Journal of
Vehicle Structures & Systems
Available online at www.maftree.org/eja

Synthesis and Characterization of Al 7075 Alloy Reinforced with Silicon Carbide and Fly Ash

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ABSTRACT:

Metal matrix composites are of great interest in industrial applications for its light weight with high specific strength, stiffness and heat resistance. The processing of MMCs by stir casting process is an effective way of manufacturing. In this paper the comparison of mechanical properties of Aluminium 7075 as a base metal and varying composition of fly ash by 3 and 6 wt.% SiC and 7% fly ash as reinforcement is carried out. Scanning electron microscope was used to confirm the presence of SiC and fly ash. The composites with 6% SiC was found to have maximum hardness whereas composites of 6% and 5 % fly ash were found to have minimum hardness. The mechanical properties such as wear resistance were studied. From the results, it has been finalized that the addition of 6% SiC was identified to show the least wear rate.

KEYWORDS:

Fly ash; Silicon carbide; Stir casting; Metal matrix composites

CITATION:

G. Sathishkumar, S.J. Irudayaraja, S. Sivaganesan and M. Thuyavan. 2019. Synthesis and Characterization of Al 7075 Alloy Reinforced with Silicon Carbide and Fly Ash, *Int. J. Vehicle Structures & Systems*, 11(3), 273-276. doi:10.4273/ijvss.11.3.10.

1. Introduction

Aluminium alloys are preferred engineering material for automobile, aerospace and mineral processing industries for various high performing components that are being used for varieties of applications owing to their lower weight and excellent thermal conductivity properties. Aluminium alloy 7075 possesses very high strength, higher toughness and are preferred in aerospace and automobile sector [1]. The composites formed out of aluminium alloys are of wide interest owing to their high strength, fracture toughness, wear resistance and stiffness. Further these composites are of superior in nature for elevated temperature applications when reinforced with ceramic particles [2]. Conventional monolithic materials have limitations with respect to achievable combinations of strength, stiffness, and density. In order to overcome these shortcomings and to meet the ever-increasing engineering demands of modern technology, metal matrix composites are gaining its importance [3-5].

In recent years, discontinuously reinforced aluminium based metal matrix composites (MMC) have attracted worldwide attention as a result of their potential to replace their monolithic counterparts primarily in the automobile and energy sector. The basic idea is that continuous fibre reinforced composite has better strength but the processing methods is highly expensive which hinders their adoption. The continuous fibre reinforced composites do not allow secondary forming such as rolling, forging and extrusion. As results of these limitations new efforts on the research of discontinuous reinforcements have been focused. At early stages of MMC development were emphasized on the preparation of fibre reinforced composite only. Now-a-days, the particulate reinforced Al matrix composite are gaining importance because of their low cost with advantage like isotropic properties. The strengthening of Al alloys with dispersion of fine ceramic particulate composite materials were developed as the alternatives to unreinforced alloy, for obtaining materials with high stiffness (high strength/modulus and low density) with special interest for the wear resistant and structural applications [7-11]. The dispersion strengthened alloys can be classified, based on the size and volume % of particles uniformly dispersed in the matrix.

Al MMC are produced either by casting or by power metallurgy. The former has the advantages of producing the composites at lower cost and possibility of producing larger components. However, the inherent difficulties of casting route are non-wet ability of ceramic particles by liquid aluminium. The most conventional method of production of composites by casting route is vortex method. Aluminium alloy 7075 is chosen and reinforced with silicon carbide & fly ash particulates. Different weight fractions of SiC and fly ash (FA) are used. The present investigation focuses on utilization of waste fly ash in useful manner by dispersing it in aluminium matrix to produce composite. To increase the wet ability, magnesium and silicon were added. These composites are characterized with the help of scanning electron microscope (SEM) and mechanical hardness tests.