A REVIEW ON INVENTION AND DEVEIOPEMENT OF METAL MATRIX COMPOSITE (MMC)

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ABSTRACT: -

A composite material is a material consisting of two or more physically and/or chemically distinct phases. The composite generally has superior characteristics than those of each of the individual components. When the matrix is a metal, the composite is termed a metal-matrix composite (MMC). In MMCs, the reinforcement usually takes the form of particles, whiskers, short fibers, or continuous fibers.

Keywords:.composite , matrix

1. Introduction

In the present study a modest attempt was made to develop Aluminum based Silicon Carbide (AlSiC) with an objective to develop a conventional low cost method of producing MMCs.

Two step-mixing method of stir casting technique has been proposed and subsequent Experiments are planned for conducting varying weight fraction of SiC (in the steps of 5%)while keeping all other

parameters like furnace temperatures, stirring speed & total mass of material mixture constant.

The results were evaluated by Brinell Hardness Test,Charpy Impact Test .The trend of hardness and impact strength with increase in weight percentage of SiC were observed and recommendation made for the applications accordingly.

2.1 Literature Survey The literature concerning with mainly mechanical, tribological and thermal properties have been included, that mainly focuses on aerospace and automotive applications. The research efforts and directions related to the present work have been identified through literature survey. The research papers concerning with the various properties of composite materials are discussed in this section. C G Kang et al.

[8] in their paper have described the one-dimensional heat-transfer analysis during centrifugal casting of aluminum alloy and copper base metal matrix composites containing Al2O3, SiCp, and graphite particles. The model of the particle segregation has been calculated by varying the volume fraction during centrifugal casting, and a finite difference technique has been adopted. The results indicated the thickness of the region in which dispersed particles are segregated due to the centrifugal force is strongly influenced by the speed of rotation of the mold, the solidification time, and the density difference between the base alloy and the reinforcement. This study also indicated the presence of particles increases the solidification time of the casting. J. Zhang et al. [9] have investigated the effect of Silicon Carbide and Graphite particulates on the resultant damping behavior of 6061 A1 metal matrix composites to develop a high damping material. The microstructural analysis has been performed using scanning electron microscopy, optical microscopy and image analysis. It was shown that the damping capacity of Al 6061 could be significantly improved by the addition of either Silicon Carbide or graphite particulates through spray deposition processing. M. L. Ted Guo et al. [10] in their research paper have studied the tribological behavior of selflubricated Aluminium/Silicon Carbide/Graphite hybrid composites with various amount of graphite addition synthesized by the semi-solid powder densification (SSPD) method. It has been found that the seizure phenomenon which occurred with a monolithic aluminium alloy did not occur with the hybrid composites. The 228 IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 5, May 2015. www.ijiset.com ISSN 2348 – 7968 amount of graphite released on the wear surface increased as the graphite content increased, which reduced the friction coefficient. Graphite released from the composites bonded onto the wear surfaces of the counter faces. R.F. Cooper et al. [11] in their study have presented Silicon Carbide continuous fibre-reinforced glass and glass-ceramic matrix composites showing high strength and fracture toughness using thin-foil transmission electron microscopy and scanning transmission electron microscopy (AEM). The exceptional mechanical behaviour of these materials is directly correlated with the formation of a cryptocrystalline carbon (graphite) reaction-layer interface between the fibers and the matrix. AEM results are used to comment upon a possible mechanism for the high-temperature embrittlement behavior noted

for these materials when they undergo rupture in an aerobic environment. L.C. Davis et al. [12] in their research thesis have explained the thermal conductivity of metal matrix composites, which are potential electronic packaging materials, has been calculated using effective medium theory and finite element techniques. It has been found that Silicon Carbide particles in Al must have radii in excess of 10 μm to obtain the full benefit of the ceramic phase on the thermal conductivity. Comparison of the effective medium theory results to finite element calculations for axisymmetric unit cell models in three dimensions and to simulation results on disordered arrays of particles in two dimensions confirms the validity of the theory. S Cem Okumus, Sredar Aslan et al. [13] in their paper have studied on Thermal Expansion and Thermal Conductivity behaviours of Al/Si/SiC hybrid composites. It clearly highlights that Aluminium-Silicon based hybrid composites reinforced with silicon carbide and graphite particles has been prepared by liquid phase particle mixing and squeeze casting. The thermal expansion and thermal conductivity behaviours of hybrid composites with various graphite contents (5.0; 7.5; 10 wt.%) and different silicon carbide particle sizes (45 μm and 53 μm) has been investigated. Results indicated that increasing the graphite content improved the dimensional stability, and there was no obvious variation between the thermal expansion behaviour of the 45 μm and the 53 μm silicon carbide reinforced composites. Na Chen, Zhang et al. [14] have reviewed on metal matrix composites with high thermal conductivity for thermal management applications, it emphasizes that the latest advances in manufacturing process, thermal properties and brazing technology of SiC/metal, carbon/metal and diamond/metal composites has been presented. Key factors controlling the thermo-physical properties were discussed in detail. The problems involved in the fabrication and the brazing of these composites were elucidated and the main focus was put on the discussion of the methods to overcome these difficulties. This review shows that the combination of pressure-less infiltration and powder injection molding offers the benefits to produce near-net shape composites.

Conclusion:

Based on the reviewed literature, MMCs are one of the most challenging classes of materials to machine due to the presence of abrasive ceramic particles. Finally, the following conclusions can be drawn from the reviewed literature:

Metal matrix composites (MMCs) are gaining rapid penetration in various

applications due to their superior mechanical properties over those of unreinforced alloys. MMCs currently attracting maximum attention are those

based on aluminium alloys and reinforced with particulates of either aluminium oxide (Al2O3) or silicon carbide (SiC). These MMCs have been introduced into a few commercial applications such as automotive brake rotors, brake drums, drive shafts, etc. and some of the electronic applications such as power substrates, IGBT basses and coolers. They show greatest potential for widespread commercial applications in near future.

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