Comparative Wear Studies On Brass Coated Aluminium Composite And Uncoated Aluminium Composite

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Abstract-*Composites are just a combination of materials in such a way that the resulting materials have desired required properties. Nowadays composite materials are widely used for many numbers of applications like engineering structures, aerospace, marine application, sports and so on. Metal matrix composite, especially aluminium matrix and particulate reinforced composites are getting most applications in present days. The flyash is extracted from power plant, and among the various methods of producing MMC we had selected stir casting technique as it appears to be the best technique to introduce particles by forming vortex. Al-based metal matrix composites (AMMCs) remained as the most potential candidate to be researched on for making engineering components viable*

I. INTRODUCTION

Metal matrix composites (MMCs) have evoked a keen interest in recent times for potential application in aerospace and automotive industries owing to their superior strength to weight ratio and high temperature resistance. Metal matrix composites are increasingly found in the aerospace and automotive industry. These materials use a metal such as aluminum as matrix, and reinforcement with fibers, particulates or whiskers such as silicon carbide. Reduction in material density or increasing in stiffness, yield strength, ultimate tensile strength can be directly translated to reduction in structural weight. This two led the automobile industry and aerospace industry to develop and examine new materials with combination of low density, improved stiffness and high strength.

Aluminium is a metallic element having the chemical symbol Al, with atomic number 13. Aluminium is the world's most abundant metal and is the third most common element coming after oxygen and silicon, comprising 8% of the earth's crust. . Pure Al have Low density 2700 kg/m3 comparing to steel which has 7900 kg/m3,The versatility of aluminium makes it the most widely used metal after steel. Pure aluminium is soft, ductile, corrosion resistant, and has a high electrical conductivity. It is widely used for foil and conductor cables, but alloying with other elements is necessary to provide the higher strengths needed for other applications. Aluminium is one of the lightest engineering metals, having a high strength to weight ratio superior to steel.

Silicon Carbide is the only chemical compound of carbon and silicon. Silicon carbide is composed of tetrahedral of carbon and silicon atoms with strong bonds in the crystal lattice. It was originally produced by a high temperature electro-chemical reaction of sand and carbon. This produces a very hard and strong material.

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II. METHODOLOGY

Hypereutectic Aluminium-Silicon alloys such as LM30 will not give a surface finish or tool life equivalent to that obtainable with the more common Aluminium alloys, if the machining practice follows that normally employed for the latter alloys. However, no great difficulty should be encountered in machining LM30 alloy castings if the machining practice which has been developed for these high Silicon alloys is applied, and the castings have a wellrefined microstructure.

Casting temperatures must be kept significantly above the liquidus temperature 620-700°C. In order to prevent the formation of coarse Silicon particles, The precipitation of primary Silicon would result in a non- uniform structure having low properties and poor machinability. The pickup of gas during melting must be kept as low as possible since prolonged degassing,with Chlorine containing agents, will deplete Magnesium and Phosphorus. Flux compositions must be Sodium free, as Sodium would prevent the intended refining action of Phosphorus. Multiple in-gates and a gating ratio of 3-4 is recommended, to avoid local overheating.

III. SOLID STATE PROCESSING

Solid state fabrication of Metal Matrix Composites is a of process, in which Metal Matrix Composites are formed as a result of bonding matrix metal and dispersed phase due to

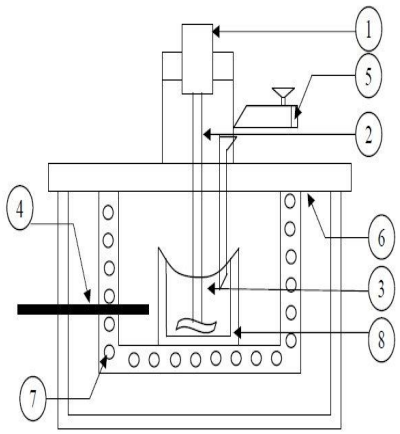
mutual diffusion occurring between them . Low temperature of solid state fabrication process depresses undesirable reactions on the boundary between the matrix and dispersed(reinforcing) phases.

IV. LIQUID STATE PROCESSING

Matrix metal, followed by its solidification. In order to provide high level of mechanical properties of the composite, good interfacial bonding (wetting) between the dispersed phase and the liquid matrix should be obtained. Wetting improvement may be achieved by coating the dispersed phase particles (fibres). Proper coating not only reduces interfacial energy, but also prevents chemical interaction between the dispersed phase and the matrix

V. STIR CASTING

Stir casting is an economical process for the fabrication of aluminum matrix composites. There are many parameters in this process, which affect the final microstructure and mechanical properties of the composites. In this study, micron-sized SiC particles were used as reinforcement to fabricate LM 30 wt% SiC composites at two casting temperatures (680 and 850 °C) and stirring periods (2 and 6 min). Factors of reaction at matrix ceramic interface, porosity, ceramic incorporation, and agglomeration of the particles were evaluated by Scanning Electron Microscope (SEM) and High Resolution Transition Electron Microscope (HRTEM).



Mechanical property testing

The following mechanical properties of the Natural fiber hybrid composite materials reinforced with Banana and sisal for different volume of fraction 20-70, 30-70 & 40-60.

1. Tensile Strength
2. Flexural Strength
3. Impact Strength

VI. CHARACTERISTICS OF THE SAMPLES FABRICATED ON THIS STUDY

The specimens were prepared for metallographic examinations using 220-320-500-1000 mesh emery papers, followed by polishing with diamond paste 1μm. Microscopic methods were used to study the composite structure and fracture surface using two kinds of scanning electron microscopes (SEM, Cam Scan Mv2300, equipped with EDAX analysis and SEM, KYKY-EM3200), and an optical microscope (OM). A high-resolution transmission electron microscope (HRTEM, Philips CM200) at an accelerating voltage of 200 kV was also used to study the reaction occurrence at the interface of aluminum matrix and SiC particles

VII. REACTION BETWEEN ALUMINIUM MATRIX AND SiC PARTICLES

It was reported that from 657 to 827 °C, SiC interacts with aluminum via a dissolution precipitation process. This mechanism involves the migration of carbon atoms from places where the SiC surface is in direct contact with the aluminum to the growing faces of Al4C3 crystals located at or close to the aluminum-SiC interface. The Al4C3 brittle compound has detrimental influences within the composite and reduces the strength and ductility, and also it reacts with liquid water or with moisture in the ambient, debilitating even more the composite

The reaction is thermodynamically possible because the standard free energy change for this reaction is negative and Al4C3 and Si are the two major interfacial reaction products [28, 34, 36]. As mentioned, the migration of carbon atoms (exchange of atoms) is involved in a chemical reaction, leading to wettability and bonding improvement. Therefore, it seems that Al4C3 formation to a low extent is suitable for required bonding between SiC and aluminum [37].However, intensive reaction between Al and SiC due to long exposure time or very high casting temperature which leads to the formation of a more thick layer of Al4C3 might not to be suitable for AMMCs

VIII. CONCLUSION

Al LM30 /5%SiCp, Al LM30 /10%SiCp and Al LM30/15%SiCp MMC have been successfully fabricated by stir casting method by two step addition of reinforcement combined with preheating of particulates.The optical micrographs of composites produced by stir casting method shows fairly uniform distribution of SiC particulates in the LM30Al alloy matrix. Alloying of Al matrix with 1wt.% Mg

and its segregation at the interfaces has been found to be effective in restricting the formation of Al4C3 at the interfaces during casting. Oxidation of SiC has prevented/restricted due to addition of flux during meltinWear studies on brass coated aluminium composite and uncoated aluminium composite are find by the analysis and the analysis are shown above .

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