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A Review Paper on Preparation of the Aluminum Metal Matrix Composite

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ABSTRACT

Aluminum metal matrix composites are gaining widespread acceptance for automobile, aerospace, agriculture farm machinery and many other industrial applications because of their essential properties such as high strength, low density, good wear resistance compared to any other metal This paper surveys about the composites, their reality, Al Metal Matrix Composites prospective materials utilized in many designing applications. The principle issue related to preparation of Al Metal Matrix Composites is lack of manufacturing processes to produce AlMMCs in mass quantity with uniform distribution of nano particles. It is essential aspect to upgrade over properties of composite materials. Hence the proposed different methods are suitable for better distribution of nano particles. The methods are named as Ultrasonic probe assisted stir casting, magnetic mixing and argon gas. A comprehensive knowledge of the properties is provided in order to have an overall study of the composites and the best results can be employed for the further development of the Aluminum reinforced composed.

The investigation shows that Al metal matrix composites can be replaced with other conventional metals for better performance and longer life. And Properties of composites can Improved like tensile strength, ductility, Flexural strength, hardness, impact strength are microstructure of the composite

Key Words: ***Aluminum; Reinforcement; Stir Casting; magnetic mixing and argon gas and nano particles.***

INTRODUCTION

To overcome the limitations of Conventional monolithic materials in achieving good combination of strength, stiffness, toughness and density etc. and to meet the ever increasing demand of modern day technology, composites are most promising materials of recent interest.

WHAT IS COMPOSITE

Composite is a material made from two or more constituent materials such as combination of matrix and reinforcement. With significantly different physical or chemical properties which remain separate and distinct at the macro or micro scale within finished structure. Where Matrix is continuous phase and surrounds the reinforcements and the reinforcement is the disappeared phase, which normally bears the majority of stress.

CLASSIFICATION OF COMPOSITE

Polymer Matrix Composite: It is used for high strength and stiffness and the applications are aerospace and marine. Fiber generally glass. Matrix can be classified as Thermoplastic (nylon, pe, ps etc...)And thermosets (epoxy, polyester)

Ceramic Matrix Composite: Ceramic matrix such as alumina calcium and aluminum silicate reinforced by fibers such as carbon and silicon carbide. And it is used high temperature and stress applications (i.e automobile, aircraft gas turbine engines.)

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Metal Matrix Composite: typical fibers include carbon and silicon carbide. It is used for higher specific strength modulus by reinforcing low density metals such as aluminum, steel and titanium.

LITERATURE REVIEW

In this paper mainly preparation of A metal matrix composite (MMC) is a composite in which two or more reinforced materials are added to the metal matrix in order to improve the properties of the composite. A hybrid metal matrix composite (HMMC) consists of three or more composites mixed with the matrix. Apart from metal matrix composite, there is polymer matrix composite (PMC) and ceramic matrix composite (CMC). In general, metal matrix is favored over polymer matrices because of its ability to meet the engineering demand. Composites are the most promising material of recent interest. In the modern applied sciences, the concept of mixing two dissimilar materials has gained much attention [1]. The combinations provide unique properties. The composite industry has begun to recognize the commercial application of composites which promise to offer much larger business opportunities in aerospace and automotive sectors [2]. The most commonly used metal matrix is aluminum, magnesium, titanium and their alloys. Aluminum metal matrix composites (AMMC) are the composites in which aluminum is used as the matrix and several reinforced materials are embedded into the matrix. Some of the reinforced materials are silicon carbide, graphite, fly ash, particulate alumina, red mud, cow dung, rice husk etc. AMMC are in demand due to their properties like low density, high specific strength, high damping capacity, high thermal conductivity, high specific modulus, and high abrasion and wear resistance [3], low density, good mechanical properties, low thermal coefficient of expansion, better corrosion resistance [4], high strength to weight ratio and high temperature resistance [5] etc. Aluminum metal matrix composite provides lesser wear resistance when compared to steel and hence it is widely used as a matrix metal. The AlMMC can be manufactured by various manufacturing techniques such as stir casting, powder metallurgy, pressure infiltration, squeeze casting [6], chemical vapor deposition etc. Amongst all the processes, stir casting is the most common method used by the researchers [7]

METHODS TO PREPARATION OF Al METAL MATRIX COMPOSITES

Stir Casting: Stir casting technique is simple and the most commercial method of production of metal matrix composites. In preparing metal matrix composites by the stir casting method, there are several factors that need to be considered [8], including: 1. Difficulty in uniform distribution of the reinforcement material. 2. Wettability between the two main substances. 3. Porosity in the cast metal matrix composites, and 4.Chemical reactions between the reinforcement material and the matrix alloy. In conventional stir casting method, reinforced particulate is mixed into the aluminum melt by mechanical stirring. Mechanical stirring is the most important element of this process. After the mechanical mixing, the molten metal is directly transferred to a shaped mould prior to complete solidification. The essential thing is to create the good wetting between particulate reinforcement and aluminum melt. The distribution of the reinforcement in the final solid depends on the wetting condition of the reinforcement with the melt, relative density, rate of solidification etc. Distribution of reinforcement depends on the geometry of the stirrer, melt temperature and the position of the stirrer in the melt. Figure 1 shows a schematic diagram of stir casting process.

Ultrasonic probe assisted method

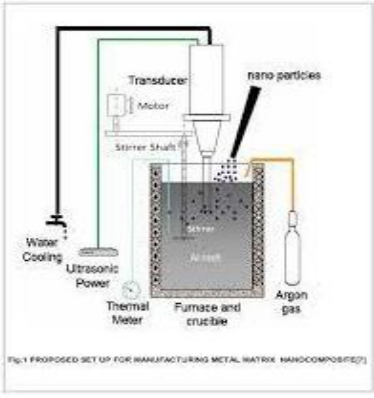

Fig.1: Ultrasonic probe assisted stir casting

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Scattering of nano sized reinforcement in metal matrix composite is challenging due nano sized particles large surface to volume ratio which results in agglomeration and clustering. This influences the resulting properties of composite materials. Poor wet ability of nano particles also produces the composite with inferiormechanical properties [8]. The ultrasonic probe assisted sonication method helps in this case to uniformly distribute the particles in metal matrix. The ultrasonic energy is widely used in the manufacturing for welding, casting and Non Destructive testing. The ultrasonic cavitation effect is utilized to generate nuclei in casting. The ultrasonic cavitations based processing of MMCs has been effectively utilized by researchers to fabricate bulk metal matrix composite [9]. The process is very effective in dispersing nano sized particles in the metal matrix. The process generally requires resistance heating furnace for melting metal, nano particle feeding mechanism, inert gas envelope for protection and an ultrasonic system. The ultrasonic processing system consists of an ultrasonic probe, a transducer and power source.

Magnetic Mixer

Fig.2: Magnetic Mixture

A magnetic stirrer or magnetic mixer is a laboratory device that employs a rotating magnetic field to cause a stir bar immersed in a liquid to spin very quickly, thus stirring it. The rotating field may be created either by a rotating magnet or a set of stationary electromagnets, placed beneath the vessel with the liquid. The mixtures of particulate filled composite were made by hand stirring. Slight modification in mixing condition is helpful for improvement in mechanical properties. In this paper, mechanical properties of the composite have been studied with respect to mixing condition. In the case of the magnetic stirring, a steel ball is placed inside the beaker and placed over the steel plate that helps in proper mixing [10]

Argon Gas Mixture

Different gas mixtures are required for different metals, composites, their thickness quality of weld and more. Commonly argon gas mixtures used for welding aluminum, steel, bronz, copper and carbon steel. And the application of argon gas mixture is electronic and automotive manufacturing industries.[11]

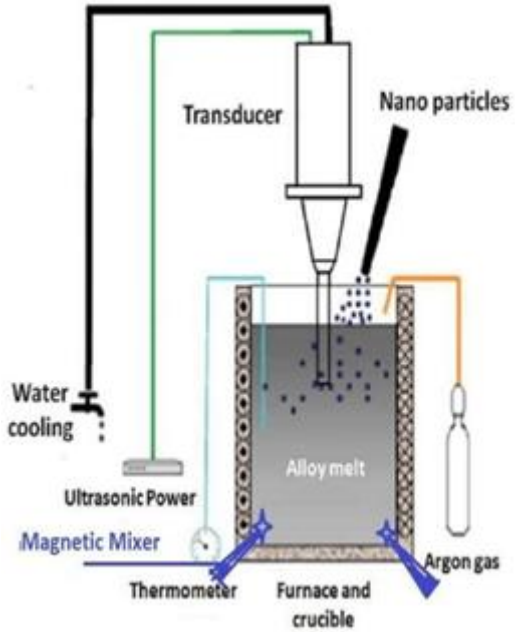

Fig.3: Imaginary Set for Manufacturing Al Metal Matrix Composites.

CONCLUSION:

After the study about the manufacturing of Al Metal Matrix Composites we conclude it that various preparation methods can be used for the manufacturing of Al Metal Matrix Composites and they vary from

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Ultrasonic probe assisted Stir casting method was found very economical and beneficial for the manufacturing of composites as various researchers used this method for their work and it can be also modified with Magnetic Mixer and Argon gas proposed that gives to better mixing of reinforcement in the melt and better uniform distribution of nano particles. On these parameters the mechanical properties of AlMMCs at an optimum rate can improve various mechanical properties like tensile strength, hardness, density and microstructure of the composite

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