Mechanical Properties Evaluation of TiB2&Nb Reinforced Aluminium 7075 For Pump Impeller Applications

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***Abstract*—Aluminum composites were largely used in automobiles industries due to their light weight and corrosion free characteristics. Mechanical properties of Aluminum alloy were improved by the reinforced of TiB2. The composites were fabricated by three varying the volume percentage of TiB2 particles and Niobium. The composite materials can be manufactured by stir casting method. The mechanical properties were evaluated by different testing method and also microstructures of the composite were seen in the FESEM test. The test results show that overall mechanical properties of different composite samples were better than bare metal. The pump impeller was fabricated and analysis the deformation and stress by using ANSYS 16.2 version software.**

***Index Terms* — Aluminium Composite, Mechanical properties, TiB2, Niobium.**

I. INTRODUCTION

The ever-increasing demand for light weight, fuel efficiency and comfort in automobile industries has lead to the development of advanced materials along with optimized design. The increased demand for light-weight materials with specific strength in the aerospace and automotive industry has spread the development and use of one group of composites: metal-matrix composites (MMCs). MMCs are widely used in industries, as they have excellent mechanical properties and wear resistance. MMCs have slowly replaced some of the conventional light-weight metallic alloys such as the various grades of aluminum alloys in applications where low weight and energy saving are important considerations and yet without sacrificing the strength of the components.

A metal matrix composite (MMC) can be defined as a metallic matrix (usually an alloy of Al, Cu, Fe, Mg, Ti or Pb) containing three-dimensional inclusions (usually an oxide, carbide or nitride).In these MMCs, the good ductility of the metallic alloy as the matrix material is retained while the modulus and strength of the composites are increased as a result of the reinforcement phases. By the correct combination of matrix material and reinforcements, MMCs can be tailored to give superior electrical, mechanical and even chemical properties. This is especially important in cases when monolithic metals and alloys can no longer fulfill the increasingly stringent requirements demanded by designers and engineers in newer engineering applications.

II. PROCEDURE FOR PAPER SUBMISSION

The aluminum metal matrix composite materials is the combination of two or more constituents in which one is matrix and other is filler materials (reinforcements). Aluminum metal matrix may be laminated, fibers or particulates composites. These materials are usually processed through powder metallurgy route, liquid cast metal technology or by using special manufacturing process. The processing of discontinuous particulate metal matrix material involves two major processes (1) powder metallurgy route (2) liquid cast metal technology. The powder metallurgy process has its own limitation such as processing cost and size of the components. Therefore only the casting method is to be considered as the most optimum and economical route for processing of aluminum composite materials. For alloy development

aluminum 7075rod and Titanium Di Boride average particles size 200μm were purchased from local market. The aluminum rod was melted in a graphite crucible and alloyed with required quantity of reinforcements.

III. METHODOLOGY

The requirement of composite material has gained popularity in these days due to their various properties like low density, good wear resistance, good tensile strength and good surface finish. Titanium di boride and Niobium is one of the least expensive and low-density reinforcement. The Tensile strength and wear will also be taken into consideration. For the achievement of the above, an experimental set up is prepared where all the necessary inputs will be made. In this work a composite is developed by adding TiB2&Nbin Aluminum metal by weight ratio with various percentages. The composite has to be prepared by crucible casting technique and has to be analyzed various mechanical properties.

IV. MATERIALS AND METHODS

Al 7075 has a good surface finish, high corrosion resistance is readily suited to welding and can be easily anodized. Most commonly available as T6 temper, in the T4 condition it has good formability.

Titanium di boride (TiB2) is well known as a ceramic material with relatively high strength and durability as characterized by the relatively high values of its melting point, hardness, strength to density ratio, and wear resistance. Current use of this material, however, appears to be limited to specialized applications in such areas as impact resistant armor, cutting tools, crucibles, and wear resistant coatings. An important evolving application is the use of TiB2cathodes in the electro-chemical reduction of alumina to aluminum metal. Other applications may develop rapidly if the electrical discharge machining of TiB2can be perfected. Broader application of this material may be inhibited by economic factors, particularly the cost of dandifying a material with a high melting point, and concerns about the variability of the material properties. The present paper addresses the latter issue by examining the physical, mechanical, and thermal properties of TiB2asa function of density and grain size.

Niobium is a grey, crystalline metallic element with high temperature resistance and other desirable properties for manufacturers. It is most commonly used in the creation of numerous metal alloys. Small amounts of niobium (as little as 0.1%) can significantly improve a metal's performance characteristics. Admit Inc. offers pure, alloy, and oxide niobium products in a variety of forms, including sheets, plates, rods, wires, tubes, strips, foils, and oxides.

V. CONCLUSION

Composite materials especially Aluminum 7075 and Titanium di boride and Niobium composites having good mechanical properties compared with the conventional materials. It is used in various industrial applications these materials having light weight along with high hardness.

From the investigation of the mechanical property of Al7075 metal matrix were analyzed finally found titanium di boride reinforcement enhanced the good tensile and corrosion resistance properties of Ratio 2-Al7075+TiB2 3% + Nb 2% is better than the Ratio 3-Al7075+TiB2 2% + Nb 3%properties. It shows superior Tensile strength compared than bare material and Ratio-3. Based on the FEA analysis we have found minimum deformation, stress and strain occurs Ratio 2-Al7075+TiB23%+Nb 2%is very low value compare than other ratio. So, we concluded regarding deformation and stress ratio of Al7075+3% TiB2+2% Nb is better than other composites and bare Al7075.

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