Analysis of Tribological Behavior of Aluminum Metal Matrix Composite Reinforced with Rise Husk Ash (RHA) using Response Surface Methodology: A Review

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Abstract— The main intention of introducing this thesis is to achieve the optimization of Tribological Behavior of Aluminum Metal Matrix Composite Reinforced with Rise Husk Ash (RHA) using Response Surface Methodology. On the basis of exhaustive literature review, it has been found that Reduction of fuel consumption and vehicle emissions is major challenge in front of automotive industry. Which can achieved by reducing weight of vehicle and frictional losses in engine. Aluminium is lighter than standard materials used in engine industry (grey cast iron and steel). Its utilization reduces mass, and increases the efficiency, and thus satisfies the basic requirements on fuel economy and vehicle emissions. Unfortunately their tribological properties are not satisfactory, which limits their application in manufacturing the tribomechanical components. One of the possible solutions for this problem is use of Aluminium Metal Matrix Composites (AMMCs). It can utilized for manufacturing pistons, cylinders, engine blocks, brakes and power transfer system elements.

Keywords: Rise Husk Ash (RHA), Aluminium Metal Matrix Composites (AMMCs)

I. INTRODUCTION

The biggest advantage of modern composite materials is that they are light as well as strong. By choosing an appropriate combination of matrix and reinforcement material, a new material can be made that exactly meets the requirements of a particular application. Composites also provide design flexibility because many of them can be molded into complex shapes. The Composites have high stiffness, strength, and toughness, often comparable with structural metal alloys. Further, they usually provide these properties at substantially less weight than metals: their "specific" strength and modulus per unit weight is near five times that of steel or aluminum. This means the overall structure may be lighter, and in weight-critical devices such as airplanes or spacecraft this weight savings might be a compelling advantage. Own side is often the cost.

II. APPLICATIONS

- Engineering structures in dusty environment
- Low cost building materials in deserts
- Partition boards
- False ceilings
- Exhaust fan blades
- Nozzles and diffusers
- Light weight vehicles

III. METHODOLOGY

- Processing of RHA
- Weighing of Powder
- Mixing in automatic mortar pestle machine
- Powder filled in die and cold compacted
- Sintering
- Preparation of sample for characterization and wear and mechanical properties testing
- Characterization of sample SEM etc.
- Hardness testing
- Wear testing Pin on disc
- SEM of worn out surface

IV. PROBLEM IDENTIFICATIONS

1) For development of Aluminium Metal Matrix Composite (AMMCs) there is a need of a cheaper reinforcement rather than another reinforcements Sic, Al_2O_3, TiC. So that cost of product can be reduced.
2) Now a day air pollution due to crop residue burning is one of the major problem in front of our country. Utilization of crop residue for some work can solve the problem up to a certain extent

A. *Machining and polishing*

Each sample was sectioned in the form of pellet with the help of hex blade and Cutting machine and polished properly with the help of grit paper in sequence of 240, 320, 400, 600, 1000, 1200, 1500, 2000 grit. The fine disc polishing was doing done by cloth polishing machine.

B. *Scanning electron microscopy (SEM)*

Microstructural characterization of polished samples was carried out by scanning electron microscopy (JEOL SEM Equipment). Ferric chloride solution (5 g FeCl3 and 50 ml HCl in 100 ml distilled water) was used as an etchant to selectively attack the grain boundaries. Micrographs were taken at 20KV accelerating voltage. The morphology of the reinforcement particle, particle distribution, reinforcement particle-matrix integrity, matrix cavitations and grain size was observed from the SEM micrographs.

V. HARDNESS TESTING

Hardness testing was done by Rockwell hardness tester. Rockwell hardness was measured on polish surface of the sample using B scale in Rockwell hardness tester. A steel ball indenter with fixed indentation load of 100kgf was used for all the test .Three reading was taken for the sample of each composition and average hardness was determined.

A. *Study of Tribological Behavior*

For the study of tribological study of prepared specimen wear and frictional studies of specimen is done by the help of pin on disc wear testing machine

VI. RESULT AND DISCUSSION

- First of all sample is polished properly with grit paper 120, 240, 320, and 400 grit paper in order to obtained uniform surface , that the sample(pin) properly mounted over disc.
- Then open the sample holder with the help of screw driver and mount the sample on disc properly ensure that pin is properly mounted on disc as shown in Figure
- Then set the test parameter according to calculation.
- When wear test performed by varying sliding distance time and track radius also calculated and set according to calculation.
- Then start the test.
- Worn out sample is cut with the help of hexa blade and wear debris is collected after different test for microstructural analysis of worn out surface.
- After each test disc was cleaned with acetone.
- On these property and wear testing we find the optimized result and try to resolve the problems.

