Characterization behaviour of aluminium matrix hybrid composite - A Review

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Abstract: This paper presented the review of past years researches work already done in this field. There is less no. Of research had been done in the hybrid composite. Current engineering applications require a materials that are stronger, lighter and less expensive. Development of hybrid material has been an important area of researches. Conventional and single composite materials have many limitations. The present work reveals the mechanical properties of Al2024, Tungsten carbide & Molybdenum. The reinforced with different weight fraction 0% to 6%. The aim of the present research is detailed study of hybrid composite on mechanical & wear behaviour. We will compare mechanical properties like tensile, density, hardness and wear behaviour.

Introduction
Aluminium is one of the most used element on the earth in the engineering field and many competitor in the engineering application. In 21st century there is heavy demand for new generation of materials. It is necessary to have high machinery service life. No single metal can meet all the required property. Hybrid aluminium composites fulfills the demand ease of processing, reduction in cost and improved mechanical properties. Aluminium alloys are ideal engineering materials for automobile, aerospace and mineral processing due to its high strength, stiffness, wear resistance, thermal conductivity and low density metal matrix composites combination of two or more materials. These may improve specific stiffness they are much expensive than (PMC). Aluminium based metal matrix composites have several application such as armour, power industry, for aerospace, automotive, and automobiles which improves the fuel economy as well as engine performance.

Hybrid composites are more advanced composites as compared conventional composites. It have more flexibility as compared to other composites.

Advantages of hybrid composites over other composites –
- High specific strength
- High specific stiffness
- Improved wear resistance
- Low density
- Improved weight ratio
- Good corrosion resistance
- High thermal expansion.

Literature Review –
- Hari Prasad Rao et al.(1) have investigated the effect of reinforcement tungsten carbide on the physical properties of the composites like sem, xrd. And shows that the improvement of physical properties for composites of Al/WC has been compared with pure aluminium.
- Abhijith R et al.(2) In this paper concentrates on the stir casting process, process and material parameters, this papers shows the preparation of MMC. Using tungsten carbide as reinforcement. It also investigated the mechanical properties like wearness and microhardness and wear properties of the prepared metal matrix composite improved.
- Srikanth B.G et al.(3) In this investigation aluminium (6061) as base matrix metal and tungsten carbide and fly ash as reinforcement with different weight fractions. From the result found that the tensile strength and hardness increased with increased in tungsten carbide and fly ash content.
- M.Rajaram Narayana et al.(4) studied the effect of friction stir processing on microstructure and property of aluminium. It compared modify aluminium microstructure to base alloy material from the result shows that the mechanical properties like hardness value increase due to surface modification as compared to the base aluminium alloy.
- A.anish et al.(5) In this investigation Al7075 has taken as base material. Tungsten carbide and Molybdenum disulphide as reinforcement. The different combination sets of composites prepared of 2% to 10%. It was found that hardness tensile strength increases upto 6% Tungsten carbide used 8% to 10% decreasing trend of hardness is found.
• K.punith Gowda et al.(6) In this research study of mechanical properties of Al(2024) with reinforced upto 0 to 5 % tungsten carbide. And result shows the content of tungsten carbide increased there was increase in the ultimate tensile strength, hardness.
• D.S ebenezer jacob et al.(7) In this investigation. Discussed the hybrid aluminium, mechanical properties and microstructure. It found that addition of tungsten carbide and graphite have superior mechanical properties.

3. Methodology –

The fabrication of the composite material is done by various methods like stir casting, powder metallurgy, squeeze casting, compo casting and In situ process. But in most of the previous researches found that stir casting is widely used. Stir casting fabrication technique is used because of its simple method and low cost. Stir casting is technique of composite material in this process a dispersed phase material is mixed with a molten metal. The matrix material is heated to above its liquidus temperature so that the metal is totally melted. The melt is cooled down to a temperature between the liquidus and solidus points and kept in a semi solid state. After that powder is mixed and preheated to 450 degree celcius to remove the absorbed hydroxide and other gases from the surface. The temperature of the furnace should be maintained between 800 to 850 degree celcius during the stirring process.

4. Gaps from literature –
• A limited no. Of literature surveys have been done on the Al2024/WC metal matrix composite. We considering all the properties and parameters. Such as mechanical properties like density, hardness, tensile strength, microstructures and wear behaviour.
• Work is reported on the synthesis of Al/WC /Fly ash composite less on hybrid composite material.
• Least work is reported on parameters like holding time, speed and melting temperature.
• Analysis of microstructure at particular composition of Al 2024 / WC are very less.
• Fabrication of composite is widely done by the stir casting among other processing because it simplest and cheapest form.

5. Applications of (HAMCs)

Hybrid matrix composites (HAMCs) are used for fabrication of aeronautical and aerospace components, automotive parts (pistons, cylinders, head and block chasis, brake components, defence weapons, safety instruments).

6. Conclusions –

In this present paper investigation are as follows-
• The strength of metal matrix like tensile strength increased as addition of reinforced particles but at particular percentage.
• Maximum strength observed upto 6 % WC and 4% Molybdneum.
• Aluminium composite is successfully fabricated by stir casting technique.
• The specific wear rate increased upto 8% to 10% WC used.
• Maximum hardness in the aluminium is observed at 6% wc.

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