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AN INVESTIGATE THE MECHANICAL CHARACTERISATION OF AL 7029 / ZIRCONIUM OXIDE & GRAPHITE METAL MATRIX COMPOSITE

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***Abstract*—** Aluminium metal matrix composites are one of the new materials used for various applications due to their less cost and light weight. Creep is the tendency of solid material to slowly move or deform permanently under the influence of stresses when subjected to high temperatures for long duration of time. So creep is one of the major considerations while analyzing the materials which are used for high temperature for long durations. Favorable properties of composites materials are high stiffness and high strength, low density, high temperature stability, high electrical and thermal conductivity, adjustable coefficient of thermal expansion, corrosion resistance, improved wear resistance etc. Metal Matrix Composites are composed of a metallic matrix (Al, Mg, Fe, Cu etc) and a dispersed ceramic (oxide, carbides) or metallic phase(Pb, Mo, W etc). Aluminium& Zirconium di oxide with graphite alloys are occupying attention of both researches and industries as a promising material for tribological applications. These are light weight having good malleability, formability, high corrosion resistance and high electrical and thermal conductivity. In this work a composite is developed by adding Zirconium di oxide with graphite in Aluminum metal by various volume based ratio composite has to be prepared by crucible casting technique and has to be analyzed various mechanical properties.

***Keywords* --** Constituent materials , ZIRCONIUM

I. INTRODUCTION

The advancement of technology requires material with an unfamiliar combination of properties that cannot be met by the metals, conventional metal alloy, ceramics and polymeric materials. A composite is a combination of two or more dissimilar materials having a distinct interface between them such that the properties of the resulting material are greater to the specific constituting components. Metal matrix composite consist of superior properties are high strength, high stiffness, high elastic modulus, high electrical and thermal conductivity, high thermal stability and exhibits greater resistances to corrosion, oxidation and wear comparable to conventional material. Composite material is composed of two or more constituent phase: matrix phase and reinforcement phase. The discontinuous phase in composites is usually harder and stronger than continuous phase and is called reinforcing agents. The continuous phase is called as the matrix.

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II. COMPOSITE TECHNOLOGY

Composite materials are materials made from two or more constituent materials with significantly different physical or chemical properties which remain separate and distinct on a macroscopic level within the finished structure. In an advanced society like ours we all depend on composite materials in some aspect of our lives.

Fiber glass, developed in the late 1940s, was the first modern composite and is still the most common. It makes up about 65 per cent of all the composites produced today and is used for boat hulls, surfboards, sporting goods, swimming pool linings, building panels and car bodies. You may well be using something made of fiberglass without knowing it. Composite materials are formed by combining two or more materials that have quite different properties.

The different materials work together to give the composite unique properties, but within the composite you can easily tell the different materials apart – they do not dissolve or blend into each other. Put more technically, it has both good compressive strength and good tensile strength. Composites exist in nature.

1) Uses of composites

The greatest advantage of composite materials is strength and stiffness combined with lightness. By choosing an appropriate combination of reinforcement and matrix material, manufacturers can produce properties that exactly fit the requirements for a particular structure for a particular purpose Modern aviation, both military and civil, are a prime example. It would be much less efficient without composites.

2) Constituent materials

Composites are made up of individual materials referred to as constituent materials. There are two categories of constituent materials: matrix and reinforcement. At least one portion of each type is required. The matrix material surrounds and supports the reinforcement materials by maintaining their relative positions.

The reinforcements impart their special mechanical and physical properties to enhance the matrix properties. A synergism produces material properties unavailable from the individual constituent materials, while the wide variety of matrix and strengthening materials allows the designer of the product or structure to choose an optimum combination.

III. OBJECTIVES OF PRESENT WORK

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. Among various particulates used, Zirconium di-oxide is one of the least expensive and low density reinforcement available in huge quantities as solid waste by-product in ceramic plant. The Hardness strength 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 graphite & Zirconium di-oxide in Aluminum metal by volume ratio with various percentage.. The composite has to be prepared by crucible casting technique and has to be analyzed various mechanical properties.

IV. RELATED WORK

This chapter presents a review of the literature data available on the effect of various reinforcement types, their size and volume fraction, ageing behavior with Al based MMC's. Metal matrix composites are a combination of two phases, matrix and the reinforcement. Matrices can be selected from a number of Aluminium alloys e.g. 6061 and many reinforcement types BORON &Graphite

A.R.Sivaram [1] et.al were investigated an Aluminum composite material is produced by mixing high strength low weight material with zirconium di-oxide for different proportions (0%, 3%, 6% and 9%) by using stir casting technique. In this paper experimental tests were carried out to determine the creep strength for different proportions (0%, 3%, 6% and 9%) of Zirconium-di-oxide with LM25 by creep testing machine. SEM and microstructure analysis was also done to see the distribution and presence of ZrO2 particles in aluminium alloy.

M.Dharmesh [2] et.al were studied deals with the investigation of effect of reinforcement (Zirconium dioxide) particles on mechanical properties of aluminum alloy (Al6061) composites, fabricated by stir casting method. The MMC's specimens were prepared by varying weight fraction of the reinforced particles as 0 Wt.%, 2.5 Wt.%, 5 Wt.%, and 7.5 Wt.% and keeping all other parameters constant. The microstructure and mechanical properties of fabricated MMC's were analysed. Micro structural studies of the MMC's reveal a uniform distribution of zirconium dioxide (ZrO2) particles in the Al6061 matrix.

The mechanical properties like hardness, tensile strength and impact strength were improved with the increase in weight fraction of zirconium dioxide particles in the aluminium matrix. It was observed that the elongation decrease with increase weight fraction of zirconium dioxide particles in the aluminium matrix.

Z.E.Celiza [3] et.al were presented work is to characterize the microstructure of this alloy analyzing specimens with different contents of hydrogen. The phases were studied using optical microscopy, SEM, TEM and X-ray diffraction. The quantitative chemical analysis was performed using EDS technique.

Amol D. [4] et.al were analysis chemical characterization of metallic alloys and oxides is conventionally carried out by wet chemical analytical methods and/or instrumental methods. Instrumental neutron activation analysis (INAA) is capable of analyzing samples nondestructively. The samples of alloys and oxides were also analyzed by inductively coupled plasma optical emission spectroscopy (ICP- OES) and direct current Arc OES methods, respectively, for quality assurance purposes. The samples are important in various fields including nuclear technology. Methods: Samples were neutron irradiated using nuclear reactors, and the radioactive assay was carried out using high resolution gamma-ray spectrometry. Major to trace mass fractions were determined using both relative and internal mono standard (IM) NAA methods as well as OES methods.

Ki-Nam Jang[5] et.al were investigated Zirconium alloy cladding tube specimens were irradiated at 380 - C up to a fast neutron fluence of 7.5 - 1024 n/m2 in a research reactor to investigate the effect of neutron irradiation on hydride reorientation and mechanical property degradation. Cool-down tests from 400 - C to 200 - C under 150 Mpa tensile hoop stress were performed. These tests indicated that the irradiated specimens generated a smaller radial hydride fraction than did the un irradiated specimens and that higher hydrogen content generated a smaller radial hydride fraction.

The irradiated specimens of 500 ppm-H showed smaller ultimate tensile strength and plastic strain than those characteristics of the 250 ppm-H specimens. This mechanical property degradation caused by neutron irradiation can be explained by tensile hoop stress induced micro crack formation on the hydrides in the irradiation damaged matrix and subsequent micro crack propagation along the hydrides and/or through the matrix.

V. MATERIALS AND METHODS

1) ZIRCONIUM

Sometimes known **as zirconium** (not to be confused with zircon), is a white crystalline oxide of zirconium.

It is a stabilized cubic structured zirconia, cubic zirconia, is synthesized in various colours for use as a gemstone and a diamond simulant. Zirconium dioxide is one of the most studied ceramic materials. ZrO_2 adopts a monoclinic crystal structure at room temperature and transitions to tetragonal and cubic at higher temperatures.

The change of volume caused by the structure transitions from tetragonal to monoclinic to cubic induces large stresses, causing it to crack upon cooling from high temperatures. When the zirconia is blended with some other oxides, the tetragonal and/or cubic phases are stabilized. Effective dopants include magnesium oxide (MgO), yttrium oxide

(Y_2O_3, yttria), calcium oxide (CaO), and cerium (III) oxide (Ce_2O_3).Zirconia is often more useful in its phase 'stabilized' state.

2) EXPERIMENTAL PLAN

Figure 1

VI. CONCLUSION

Composite materials especially Aluminum7029 and ZrO_2 &Graphite composites material calculated by using volume based calculated depending upon the ratio. In Phase I the material based on the literature survey and getting some idea from the experts materials were purchased, according to the standards, and material casted as per the dimension as well as hardness value was compared of various composition. In Phase II the following test are going to do to check the mechanical characteristics and machining behavior of the material. The tests are

1. Impact test
2. Tensile test
3. Wear test
4. Hardness test.

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