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Ensuring safety by manufacturing products with composite materials

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Abstract: In recent days the number of accidents is being increasing to minimize that we need some advanced materials, by this way in use of LM6 has good castability but its application is limited because of its low mechanical properties. In this present work, we have increase the tribological behaviour of LM6 by mixing Al2O3 nanomaterial and . The effect of the use of Al2O3 nanomaterial and LM6 aluminium alloy with different proportions (1%, 1.5%, 2.5%, 5% of weight) has been studied experimentally. This nano composite is casted by stir casting method. Hardness, Tensile and Wear resistance characteristics of (LM6/Al2O3) nano composite was measured. In mechanical terms, nanocomposites differ from conventional composite materials due to the exceptionally high surface to volume ratio of the reinforcing phase and/or its exceptionally high aspect ratio. The reinforcing material can be made up of particles (e.g. minerals), sheets (e.g. exfoliated clay stacks) or fibers. Based on the results, adding of nano particles to the base material (LM6) had caused a significant enhancement of mechanical properties like Hardness, Tensile and Wear resistance.Finally, the effect nano particles (Al2O3) on the pure LM6 aluminium alloy were compared to that of a conventional LM6 aluminium alloy. Comparison of the Hardness, tensile and wear resistance property in different proportions with of nanocomposite (1%, 1.5%, 2.5%, 5% of weight) are better than pure LM6. As a result, it can be used in many application

I. INTRODUCTION

The aim and the scope of the project is to attain safety for the automotive manufactured like Racing cars, Army Flights , Army Trucks, Navy ships and Industrial transportation vehicle to get more hardness of the body and also in an increased wear resisting condition so that the capability of the machine will be increased and also the withstanding capacity of the machine will be more and that supports and ensures the safety of the driver and the workers who make use of that and also by attaining more wear resistance we can ensure the durability of the manufactured product so that productivity will also be increased. In handling the vehicle with high mobility the are chances of accidents, and also in industries which carry explosive or flammable materials, intimes of accidents the loss of life will be more and to minimize that materials manufactured with morewear resistance and hardness have and increased amount of capacity to with stand and that can only be achieved by materials manufactured with composite items.The term composite refers to a matrix material that is reinforced with fibers.Composites that form heterogeneous structures which meet the requirements of specific design and function, imbued with desired properties which limit the scope for classification. However, this lapse is made up for, by the fact that new types of composites are being innovated all the time.Fibers or particles embedded in the matrix of another material would be the best example of modern-day composites, which are mostly structural.

II. WEAR COEFFICIENT AND RELIABILTY OF SLIDING WEAR TEST PROCEDURE FOR HIGH STRENGTH ALUMINIUM ALLOY AND COMPOSITE

The results of dry sliding wear tests of aluminium alloy (Al–Zn–Mg–Cu) compositewas examined under varying applied pressures (0.2–2.6 MPa) and sliding speeds of 0.52, 1.72, 3.35, 4.18 and 5.23 m/s. The wear behavior was studied using pin-on-disc apparatus against heat-treated steel counter surface, giving emphasis on the parameters such as wear coefficient as a function of applied pressure for alloy and composite for various sliding velocities. Wear coefficient of the alloy was noted to besignificantly higher than that of the composite and is suppressed further due to addition of silicon carbideparticles and applied pressure. It is noted that the experimental values are in good agreement with the theoretically calculated value. The maximum deviation of experimental values from the theoretical ones is noted to be around 10–15%. This supports the reliability of the test procedures and reproducibility of the test data.

III. NANOCOMPOSITE

A nano composite is as a multiphase solid material where one of the phases has one, two or three dimensions of less than 100 nanometers (nm), or structures having nano-scale repeat distances between the different phases that make up the material. In the broadest sense this definition can include porous media, colloids, gels and copolymers, but is more usually taken to mean the solid combination of a bulk matrix and nano-dimensional phase(s) differing in properties due to dissimilarities in structure and chemistry. The mechanical, electrical, thermal, optical, electrochemical, catalytic properties of the nanocomposite will differ markedly from that of the component materials. Size limits for these effects have been proposed<5 nm for catalytic activity, <20 nm for making a hard magnetic material soft, <50 nm for refractive index changes, and <100 nm for achieving superparamagnetism, mechanical strengthening or restricting matrix dislocation movement. Nanocomposites are found in nature, for example in the structure of the abalone shell and bone. The use of nanoparticle-rich materials long predates the understanding of the physical and chemical nature of these materials. Jose-Yacamanet al. investigated the origin of the depth of colour and the resistance to acids and bio-corrosion of Maya blue paint, attributing it to a nanoparticle mechanism. From the mid 1950snanoscaleorgano-clays have been used to control flow of polymer solutions (e.g. as paint viscosifiers) or the constitution of gels (e.g. as a thickening substance in cosmetics, keeping the preparations inhomogeneform

IV. THE ALL OVER RESULT AND DISCUSSION

The results of this study have shown that nano-sized alumina particulates 1%, 2.5% and 5% volume for every weight fraction are able to bring appreciable improvement to the hardness, tensile strength and wear resistance of pure aluminium alloy (LM6). Much of previous work on the tribology of aluminium based composites had explored materials that typically contained at least 15–20% volume micron-sized ceramic particulate reinforcement. The small volume fraction of reinforcement used presently is significant because the earlier studies have found there exists an optimum level of reinforcement for a given particulate size and sliding condition, beyond which, despite an increase in hardness, results in wear rates comparable to or even higher than the unreinforced material.In this investigation, however, wear via delaminating was noticeably absent this is likely due to the small amount of reinforcement. The dominant mechanisms of abrasion and adhesion observed here agree with an earlier report of adhesion and microploughing in silicon carbide-reinforced aluminium alloy composite with particulate sizes from 40 to 130nm, while large particulates were found to introduce delaminating and third-body abrasive wear, with an attendant increase in wear rates. In contrast, other studies on the same material system have found that larger silicon carbide particulates were more effective it was proposed that larger particulates are better able to resist the propagation of subsurface cracks in delaminating.One caveat to the above discussion is that the present wear tests have employed a relatively low normal load (only 20 N). It has been reported previously that for loads below 10 N, silicon carbide and alumina particulate reinforcement had a beneficial effect on the wear resistance of aluminum alloys due to the improved load-bearing capacity of the particulates and the formation of a transfer layer, which protected the surface from abrasive wear. One of these studies also found that for loads under 10 N, an increase in the volume fraction of silicon carbide particulates was advantageous however, when the load was raised beyond 20 N delamination wear occurred, but no correlation was found between wear rates and volume fraction

V. CONCLUSION

From the hardness, tensile and Pin-on-disc dry sliding wear tests with pure Aluminum reinforced with up to 1%, 1.5%, 2.5% and 5%volume of (40nm) Nano-sized alumina with for every weight fraction were carried out in suitable lab conditions and its properties were found. The composites exhibited improved hardness, tensile and wear resistance with increasing volume fraction of reinforcement. The tables and Graph for various tests has shown the increase in theirhardness, tensile and wear resistance of pure Aluminum alloy (LM6) reinforced with various volume ratios of Nano alumina particulates. Thus we conclude that we can achieve higher ratio of safety in an automotive product by manufacturing the product with the composition of LM6 and Al2O3 , so in times of accidents and small crashes we can safe guard the human life's and the cargo carrier carrying explosive materials may minimize the chances of big explosions ,Army flights can be ensured with an safer exterior so that can avoid damages at times of war ,Ships with an increased wear resisting condition have an advantage of sustaining more climatic disasters and also can be implemented in Navy ships and submarines ,as we see number of accidents happening around us finally ends with fatal is because of the crushing of the products exterior so our technique may not avoid accidents but for sure will help in protecting human life's from hits directly by the materials though we minimize human loss and also the durability of the product supports to avoid drastic damages to human life .Thus by adopting these type of techniques our ultimate goal of protecting human life is being achieved . The only limitation in our project is there will be a rise in manufacturing cost but compared to human life and our safety increased cost matters nothing.

REFERENCES

1. P.C. Maity,S.C.Panigrahi and P. N.Chakraborty: Script Metall.Mater., 1993, vol.28, pp

2. N. Yoshikawa, Y. Watanabe, Z.M. Veloza, A.Kikuchi,andS.Taniguchi:Key Eng. Mater., 1999, vols.161-163, pp 311.

3. KeGeng, Weijie Lu, and Di Zhang: J.Mater.Sci.Lett., 2003, vol.22, pp877.

4. R.Subramanian, C.G. Mckamey, J.H. schneibel, L.R Buck, and P.A.Menchhofer: Mater Sci. Eng., A Struct.Mater.:Prop.Microstruct. Process, 1998, vol.254, pp.119.

5. I Kerti, and F.Topan :Materials Letter 2007 doi:10.1016/j.matlet.2007.08.015.

6. A.A.Hamid, P.K. Ghosh, S.C. Jain and S.Ray: Met. and Mat Trans. A, vol 36A, 2005,

7. I.J. Polmear:Light Alloys, Edward Arnold, London, 1989, p.32.

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