Experimental Investigation of Hybrid Composite using Plastic waste

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***Abstract*** - ***The demand for aluminium hybrid metal matrix composites has increasedin recent times due to their enhanced mechanical properties for satisfying the requirements of advanced engineering applications. The performance of these materials is greatly influenced by the selection of an appropriate combination of reinforcement materials. The reinforcement materials include carbides, nitrides, and oxides. The ceramic particles, such as silicon carbide and aluminum oxide, are the most widely used reinforcement materials for preparing these composites. In this paper, an attempt has been made to prepare an Al6061hybrid metal matrix composite (HAMMC) reinforced with particulates with different weight fractions of SiC and Al2O3 and a constant weight fraction (5%) of fly ash by a stir-casting process. The experimental study has been carried out on the prepared composite to investigate the mechanical properties due to the addition of multiple reinforcement materials. The density and mechanical properties, such as ultimate tensile strength, yield strength, impact strength, andthe hardness and wear characteristics of the proposed composite, are compared with those of unreinforced Al6061. The experimental investigation is also aimed at observing the variation of properties with a varying weight percentage of the reinforcement materials SiC and Al2O3 simultaneously with the fly ash content maintained constant. The outcome of the experimental investigation revealed that the proposed hybrid composite with 20% of total reinforcement material exhibits high hardness, high yield strength, and low wear rate but no considerable improvement in impact strength.*.**

***Index Terms - hybrid metal matrix composite; multiple reinforcement materials; plastic power.*.**

I. INTRODUCTION

Metal matrix composites(MMCs) with two or more reinforcement materials, called hybrid metal matrix composites, have received considerable attention in the field of materials research as they are characterized by having lighter weight, higher strength, more wear resistance, and greater fatigue and dimensional stability than conventional composites. Specifically, the Al6061-based hybrid metal matrix composites (HAMMCs) are better substitutes for conventional aluminum alloys because of their increased strength, hardness, and strength to weight ratio and their better wear resistance. The characteristics of HAMMCs primarily depend on the type and the amount of reinforcement materials. HAMMCs can usuallybe reinforced with various oxides, carbides, nitrides, and borides in particulate, whisker, or fiberform. It is observed from the literature that silicon carbide (SiC), alumina (Al2O3), graphite(Gr), silica (SiO2), Eglass fiber, boron carbide (B4C), tungsten carbide (WC), granite dust, andfly ash are reported as reinforcement materials for Al6061-based hybrid metal matrix composites. However, silicon carbide (SiC) and alumina (Al2O3) are the most commonly employed reinforcement particulates for HAMMCs compared toother synthetic reinforcing materials.

The density of SiC is slightly greater than that of Al6061. However, it is chemically compatible with aluminium and it also exhibits adequate bonding with the matrix material without developing an inter-metallic phase. It is a low-cost material with good thermal conductivity and workability as compared to other reinforcement materials. Kumar et al. studied

the influence of SiC on the hardness of an Al6061–SiC composite. They found that theincrease of SiC from 0 to 6 wt % leads to an improvement in the hardness of the composite byan amount of 67%. This improvement can be attributed to the reason that the SiC possesses higher hardness. The presence of SiC in the composite provides an improvement in its hardness. Some attempts have been made on preparing HAMMCs with SiC and other reinforcement materials.

II. PROCEDURE FOR PAPER SUBMISSION

Hybrid composites are a new generation of metal matrix composites that have the potentials of satisfying the recent demands of advanced engineering applications. These demands are met due to improved mechanical properties, amenability to conventional processing technique and possibility of reducing production cost of hybrid composites. The

performance of these materials is mostly dependent on selecting the right combination of reinforcing materials since some of the processing parameters are associated with the reinforcing particulates. A few combinations of reinforcing particulates have been

conceptualized in the design of hybrid composites. This paper attempts to review the different combination of reinforcing materials used in the processing of performance of the materials. The major techniques for fabricating these materials are briefly discussed and research areas for further improvement on hybrid composites are suggested.

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VII. CONCLUSION

This experimental study aimed at preparing an Al6061 hybrid metal matrix composite (AHMMC) with the non-metallic ceramic reinforcement materials SiC, Al2O3, and fly ash using the stir-casting technique and to explore its mechanical characterization. The density of the proposed composite is decreased and the mechanical properties, including hardness, tensile strength, and yield strength, were slightly lowered compared to that of an Al6061 MMC reinforced with a single ceramic reinforcement material. The AHMMC prepared with equal amounts of SiC, Al2O3, and fly ash (each of 5 wt %) possesses a tensile strength of 117 MPa, a yield strength of 79 MPa, and a hardness of 53 BHN. The present study is confined to observing the variation of mechanical properties with the simultaneous increase of weight percentage of SiC and Al2O3 in equal amounts in two steps (7.5% each and 10% each) and without any change in fly ash content. The following remarks can be made.

REFERENCES

[1] S.Chen,B.Mulgrew,and P.M.Grant,― Aclustering technique for digital communications channel equalization using radial basis function networks, ‖ *IEEETrans.onNeural Networks*, vol. 4,pp.570-578,July1993.

[2] J. U. Duncombe, ―Infrared navigation—Part I: An assessment offeasibility,‖*IEEETrans.ElectronDevices*,vol.ED-11,pp. 34-39,Jan.1959.

[3] C.Y.Lin,M.Wu,J.A.Bloom,I.J.Cox,andM.Miller,―Rotation, scale,andtranslationresilientpublicwatermarkingforimages,‖*IEEETrans.ImageProcess.*, vol. 10,no.5,pp.767-782, May2001.

**(Bookstyle)**

[4] A.CichockiandR.Unbehaven,*NeuralNetworksforOptimizationandSignalProcessing*,1sted.Chichester,U.K.:Wiley,1993,ch.2,pp.45-47.

[5] W.-K.Chen,*LinearNetworksandSystems*,Belmont,CA:Wadsworth,1993, pp. 123-135.

[6] H.Poor,*AnIntroductiontoSignalDetectionandEstimation*;NewYork: Springer-Verlag, 1985,ch.4.

**(Bookstylewithpapertitleand editor)**

[7] R.A.Scholtz,―TheSpreadSpectrumConcept,‖in *MultipleAccess*,N.Abramson,Ed. Piscataway,NJ:IEEEPress, 1993,ch.3, pp. 121-123.

[8] G.O.Young,―Syntheticstructureofindustrialplastics,‖ in*Plastics*,2nded.vol.3,J.Peters,Ed.NewYork:McGraw-Hill,1964,pp.15-64.

**(Published ConferenceProceedingsstyle)**

[9] S.P.Bingulac,―Onthecompatibilityofadaptivecontrollers,‖in*Proc.4thAnnu.AllertonConf.CircuitsandSystemsTheory*,NewYork,1994, pp.8-16.

[10] W.D. Doyle, ―Magnetization reversal in films with biaxial anisotropy,‖in*Proc.1987INTERMAG Conf.*, 1987,pp. 2.2-1-2.2-6.

**(Presented ConferencePaperstyle)**

[11] G. W. JuetteandL. E. Zeffanella, ―Radionoisecurrentsnshort sections onbundleconductors,‖presentedattheIEEESummerPowerMeeting,Dallas,TX,June 22-27,1990.

**(ThesisorDissertation style)**

[12] J.Williams,―Narrow-bandanalyzer,‖Ph.D.dissertation,Dept.Elect.Eng., Harvard Univ.,Cambridge, MA,1993.

[13] N. Kawasaki, ―Parametric study of thermal and chemical nonequilibriumnozzleflow,‖ M.S. thesis,Dept.Electron.Eng.,OsakaUniv.,Osaka,Japan, 1993.

**(Patent style)**

[14] J.P.Wilkinson,―Nonlinear resonantcircuitdevices,‖ U.S.Patent3624 12,July16, 1990.

**(Standards style)**

[15] *LetterSymbolsforQuantities*,ANSIStandardY10.5-1968.

**(Handbookstyle)**

[16] *TransmissionSystemsforCommunications,*3rded.,WesternElectricCo.,Winston-Salem,NC,1985, pp. 44-60.

[17] *Motorola Semiconductor Data Manual,* Motorola SemiconductorProductsInc.,Phoenix,AZ, 1989.

**(JournalOnlineSourcesstyle)**

[18] R.J.Vidmar.(August1992).Ontheuseofatmosphericplasmasaselectromagneticreflectors.*IEEETrans.PlasmaSci.*[Online].21(3)*.*pp. 876-880. Available:http://www.halcyon.com/pub/journals/21ps03-vidmar