

# **PREPARATION AND CHARACTERIZATION OF ALUMINIUM METAL MATRIX COMPOSITE REINFORCED WITH $Al_2O_3$ - $SiO_2$ - $SiC$ SYNTHESIZED IN PLASMA REACTOR BY CARBO THERMAL REACTION OF FLY ASH**

**R. GOVINDARAO<sup>1</sup>, R. I. GANGULY<sup>2</sup>, R. R. DASH<sup>3</sup> & P. SURYA PRAKASH RAO<sup>4</sup>**

<sup>1</sup>Assistant Professor, Department of Metallurgical & Materials Engineering, GIET, Gunupur, Odisha, India

<sup>2</sup>Professor, Department of Metallurgical & Materials Engineering, GIET, Gunupur, Odisha, India

<sup>3</sup>Dean R&D, Department of Metallurgical & Materials Engineering, GIET, Gunupur, Odisha, India

<sup>4</sup>Professor, Department of Metallurgical & Materials Engineering, NIT, Warangal, Andhra Pradesh, India

## **ABSTRACT**

With the rising problem of fly ash disposal globally, constant attempts are being made to promote utilization of fly ash in different areas. One such identified area is Aluminium Metal Matrix reinforced with fly ash (ALFA) composite. Research papers suggest potentiality in this area. Some Researchers have observed that the properties of ALFA composite vary with composition of fly ash. In the present investigation fly ash is chosen containing 5% carbon in it. Fly ash is characterized chemically, micro structurally and with XRD. These are then treated specially in high temperature plasma reactor in neutral atmosphere. Treatment has caused partial conversion of  $SiO_2$  to  $SiC$  with the presence of other phases such as  $Al_2O_3$ ,  $SiO_2$  and Carbon. SEM, XRD, EDAX analyses have corroborated the above findings. Both the hardness and tensile properties such as UTS, YS, Stiffness are more for ALFA treated composite in comparison with ALFA untreated composite. Fractographs of ALFA treated sample shows appearance of dimples in different areas with large deformations at places around particles. Fractographs of broken tensile samples of ALFA untreated shows presence of fine dimples with areas having river pattern appearance in the fractured surface. One of the spots reveals shearing of the particle. The result of the tensile test, thus corroborate the SEM finding from fractographs. Abrasion studies of composites prepared with untreated and treated fly ash shows the abrasion resistance is more for ALFA treated composite than ALFA untreated composite. However, abrasion is more pronounced for both the composites beyond 3Kg load. It is observed that abrasion rate increases rapidly for ALFA untreated than ALFA treated composite. Effect of variables (such as load, speed, time) on abrasion of ALFA untreated and treated composites are quantified in the form of regression equations. These equations are statistically checked and corrected by 't' test. The validity of the equations are established using F test and with random experiments. These equations are useful to predict the abrasion resistance of two composites accurately in the range of variation of variables.

**KEYWORDS:** Plasma Synthesized MMC Composite, Flyash, Stir Casting, Wear, Statistical Design Experiment