Abstract

Composite materials play a significant role in auto, aviation, marine and defense applications due to their unique properties. Aluminum (Al) alloys have certain advantages over other alloys. In this present research the composite material comprises al alloy LM6 and fly ash (150 – 175 μm) has been picked as lattice and supporting materials individually. Magnesium (Mg) is added to lessen the surface pressure and evades the dismissal of the particles from the melts. Liquid state processing through Stir casting procedure was adopted for fabrication of metal matrix composite (MMC) into necessary shape and size according to the ASTM principles by energetically mixing at consistent speed and time. The fly ashes with various syntheses (2%, 4%, 6%, 8%) were added with LM6. The X-ray diffraction (XRD) and energy dispersive X ray analysis (EDX) were used to examine the structural analysis of MMC and optical microscopy and scanning electron micrograph (SEM) were used to investigate the microstructure on MMC. Wear test also carried out on MMC to ascertain the wear rate and coefficient of friction (COF) of different MMCs. There is substantial improvement of mechanical properties like tensile strength 112 MPa to 175.82 MPa, micro hardness 120.3 to 226.2 and density 2.43 to 2.39 kg/m^3 of the composite. Optical micrographs and (SEM) revealed that fly ash particles were evenly dispersed throughout the aluminum matrix. The XRD results revealed that very minor changes in the composition of components are occurring. Because there is less segregation during solidification in the 2% and 4% of fly ash MMC samples. They have a more uniform distribution than the other examples. It is apparent that increasing particle dispersion homogeneity leads to improved mechanical behavior. As a result, there is little doubt that the use of this material in the automotive and space sectors will be viable in the future. Friction coefficient for the composites gets reduced with increase in fly ash content for both enhanced variable values. Sliding speed, proportion of fly ash and applied stress all influenced the wear volume of composites. Due to the presence of hard particles, an increase in fly ash content reduced wear volume. A statistical analysis through Taguchi method is carried out with design of experiment (DOE). While wear analysis, it demonstrates that the strongest factor influencing how quickly al-fly ash composites wear out. Whereas load has a moderate impact and speed has the least impact among the three input parameters i.e. weight percent of fly ash, load and sliding speed based on the S/N ratio. When

assessing the wear rate of composites with analysis of variance (ANOVA), the wt. percent has the greatest impact, followed by the two other variables, load and speed. However, no interaction significantly affects the rate at which composites wear out. However COF analysis reveals that load has the greatest influence in limiting the COF of al fly ash composites, whereas speed has a moderate impact and reinforcement has the least impact. While using ANOVA it is observed, that wt. percent has the biggest effect, followed by the other two factors of load and speed in determining the COF of composites. However, no interaction has a major impact on the COF of composites.