

ABSTRACT

An increasing demand of new materials for the various fields of engineering application such as automotive, railway, marine, building component, solar panels and aerospace application. Due to wide range of application, new materials require to meet miscellaneous demands such as good mechanical strength, high resistance to wear, stable and high friction coefficient, elevated thermal stability, high stiffness, resistance to corrosion. It is very complicated to attain such properties in monolithic form or solo material. Therefore, composite material have been tailored to meet these combinations of properties for a wide range of application.

Therefore to fulfill this continuous demand of such materials up to a level, low density aluminium metal matrix composites with enhanced performances. In the present investigation, powder metallurgy and compo-casting technique are considered to be the most viable for developing the aluminium and its alloy based composites due to certain advantages, such as easy to perform and very economical. The different ceramics reinforcing phases are used such as ABO and SiO₂ coated ABO whiskers due to their high hardness, high chemical stability, and high modulus, grain refining effect, better corrosion and wear resistance. There are broadly two categories of aluminium based composites known as ABO_w. Coated ABO_w reinforced composites are developed depending on the weight percentage of reinforcement into the aluminium and its alloy (Al-319) matrix composites.

Subsequently, the developed aluminium and Al-319 alloy composites have undergone various characterisations for their microstructural, physical, mechanical, and dry sliding behavior. The various characterizing and analytical tools such as X-ray

diffraction (XRD), scanning electron microscopy (SEM), high-resolution scanning electron microscopy (HRSEM), energy dispersive analysis (EDAX), transmission electron microscopy (TEM) have utilized for microstructural observation. The hardness, mechanical strength (tensile, flexural strength, compressive strength etc.) and dry sliding wear behavior of developed material have been measured according to the specific standards. The fracture and worn surfaces behavior of all the material studied in the present investigation were examined under SEM, EDAX and SPM (scanning probe microscope).

After various characterizations, it is observed that the developed aluminum based composites have better mechanical and wear properties as compared with aluminium matrix due to uniform distribution and good wettability of the reinforcing phases in the aluminium matrix. Therefore, the developed aluminium based composites can be successfully used for various engineering applications such as structural components in electric vehicles, solar panels, railway components, marine and aerospace industries etc.

Keywords: Hydrolysis route, Coating, Powder metallurgy, Compo-casting, Physical properties, Mechanical properties and Dry sliding wear properties.