Abstract

Aluminium Matrix Composites (AMC) are the material which consist of two different phases i.e. matrix and reinforcement particles. AMC are the materials in which the light weight alloy (matrix phase) are reinforced with different ceramics particles. AMC have attracted many industries due to some of their excellent properties such as higher strength, lower weight and lower density when compared to conventional alloys. Out of several fabrication processes, the stir casting process is the frequently adopted technique for the fabrication of AMC. In the present investigation, three different compositions of AMC have been fabricated using the stir casting process. To understand the effect of the addition of reinforcement particles in aluminium matrix, microstructural mechanical and tribological properties of as-cast composites has been studied. The observed properties of as-cast composites have been compared with that of as-received aluminium alloy. It should be noted that fabrication of AMC by the stir casting process tends to have several casting defects such as void and porosity. Thus to avoid these casting defects, it becomes necessary to perform post processing treatment. In the present study, the defects observed in as-cast composites were resolved by performing Friction Stir Processing (FSP). For evaluating the effect of FSP, the metallurgical, mechanical and tribological properties of processed composites were analyzed and were compared with that of as-cast composites. Compared to as-cast composites, processed composites revealed grain refinement along with homogenous distribution of reinforcement particles. This refinement and homogenous distribution was attributed to breaking of agglomeration/clusters of reinforcement particles present in the as-cast composite. As a result of these, enhancement in mechanical and tribological properties of processed composites was observed. Apart from this, it has been observed that joining of AMC by conventional fusion welding process is difficult. In such a condition, a solid state joining process known as Friction Stir Welding (FSW) can be adopted. Thus, the present study showcases the joining of AMC using the FSW process. Characteristics of welded composites i.e. mechanical properties and metallurgical properties have been investigated and the same have been compared with as-cast composites.

Keywords: Stir Casting, Metal Matrix Composites, Friction Stir Processing, Friction Stir Welding.