Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Experimental investigation of mechanical properties of Al7075-Al_2O_3-B_4C composite via stir route

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ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Hybrid composites
AA7075
Mechanical properties
Tribological properties

ABSTRACT

Aluminium metal matrix composites have large structural applications in automobile, aeronautical, sports and defence industries. Hybrid composites having two or more two reinforcements can be used for advanced industrial applications. The properties of the composites depend on the selection of an appropriate combination of matrix, reinforcement and processing parameters. Therefore present work aims to develop hybrid aluminium composites with varying weight percentages of particulate reinforcements and investigate their mechanical and tribological properties. In this study, AA7075 is used as the matrix material and the reinforcements reinforced are alumina, boron carbide and carbon. The wear, tensile and flexural behavior of the composites are also analyzed using the scanning electron microscope.

Selection and peer-review under responsibility of the scientific committee of the Functional Materials for Energy, Environment and Biomedical Applications.

1. Introduction

Aluminium alloys and their composites are used in various applications due to their low cost, superior strength to weight ratio and good electrical /thermal conduction, high wear and corrosion resistance [1,2]. In the automotive sector, the major applications of AMMC are used in the reinforced piston for diesel engines, intake and exhaust valves, and brake components [3,4]. Aluminium composite using stir casting method by reinforcing SiC, Al_2O_3 and graphite particles. The results concluded that 18% of weight reinforcement is produced successfully by the stir casting method. The tribological, mechanical and metallurgical properties also improved significantly as compared to unreinforced matrix alloy. The composite materials were lighter as compared to the alloy due to low-density graphite particles and porosity generated during casting [5,6]. The fabricated aluminium 6061 composites are reinforced with net-shaped SiC particles using powder metallurgy. Three different aluminium alloy powder sizes and SiC particle sizes were combined to produce net-shaped tensile samples. The volume fraction of SiC particles taken was up to 20%. The tensile test results and fracture surface morphological analysis indicate that this method can yield well sintered, small-to-medium-sized net-shaped aluminium composite components [7,8]. AMMC is reinforced with alumina powder of varying particle sizes using powder metallurgy [9]. It was found that the density, hardness, wear-resistance and homogenization of micro-structure increased with an increase in sintering temperature. The results also confirmed that raising the particle size of reinforcements leads to an increase in relative density initially but then dropped to lower values [10]. Aluminium composites reinforcing SiC and B4C in three different compositions using powder metallurgy. The characteristics of the composites were studied. It was concluded that with an increase in apparent density the shrinking tendency decreases during sintering. The increase in tap density was maximum during the initial tapping period and after that it becomes constant. It was also confirmed that the tap density of silicon carbide is more than aluminium but less than that of boron carbide. The hardness of the composites decreases with a decrease in boron carbide percentage [11]. Fabricated AA7075 Al alloy reinforced with TiB2 composite using in situ reaction and studied the sliding wear characteristics of the composites. The XRD and SEM micrographs show the formation and uniform distribution of TiB2 particles. The results also revealed that at room temperature wear mode was abrasive while

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https://doi.org/10.1016/j.matpr.2022.05.498

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