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Research Article

Investigation of Wear Behaviour and Mechanical Properties of Titanium Diboride Reinforced AMMC Composites

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The aluminium metal matrix composites (AMMCs) are preferred in automotive and aerospace industries for higher strength, weight ratio, good corrosion resistance, and also better tribological properties. This study proposed that the AA7075 alloy methodology was enhanced by stir casting with titanium diboride (TiB_2) particles at different percentages (5, 10, and 15 wt. %). The preheated titanium diboride powder is spread to the molten state AA7075 at 870°C to provide good weight resistance and delivery. The prepared composites are evaluated by wear analysis, tensile properties, hardness range, and microstructural behavior studies. Pin-on-disk and Rockwell hardness tester were used to analyze the wear behaviour and hardness level. The tensile strength and hardness have defined the strength of the proposed composite while the addition of TiB_2 particles improves the hardness and tensile stress. The findings showed that adding TiB_2 particles in the Al7075 matrix strengthened all properties compared to the Al7075 matrix. The scanning electron microscope and EDS were used to analyze the eroded surface and chemical composition of composites.

1. Introduction

The AMMCs have higher usage in the automotive and aerospace industries due to their enhanced strength and low wear. Enhanced mechanical and tribological characteristics of AMMCs are provided by adding reinforcements such as Al_2O_3, SiC, TiC, TiB_2, ZrO_2, and B_4C [1]. The AMMCs were made by the infiltration, powder metallurgy process, compocasting, and stir-casting method [2]. Many researchers used a stir-casting method to make AMMCs because of the maximum metal yield range, lower particle damage, and cost-efficiency. TiB_2 particles are highly stiff and hard and had better thermal stability range among the different ceramic strengthening particles.

The exothermic nature of the process, as well as the reduced oxidation, makes it a good candidate for wear-resistant composites [3]. Normally, the composites are made with oxide particles, carbide particles, boride particles, and nitride particles. While added, the ceramic particulate matter in different aluminium matrices significantly increased the matrix wear performance [4]. Matrix reinforcement fraction is the factor that influences the composite mechanical properties. The wear has been observed to be oxidative wear to a maximum of 800°C, and the oxidative wear has been found to dominate the wearing rate at higher temperatures. Certain scientists have found that the inhomogeneous distribution of reinforcement particles on a molten matrix results in low weight and low surface tension [5]. Preheating treatment is used to absorb gas and remove humidity and utilize any sort of surface protection, and inert gas-atmospheric alloying elements will improve the properties of the composites [6]. The particulate injection