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EFFECT OF MoS_2 And CeO_2 POWDER ADDITION BY FRICTION STIR PROCESSING ON WEAR AND CORROSION PROPERTIES OF Al7075 ALLOY

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ABSTRACT

Aluminium alloys, a structural material owing to their high strength to weight ratio are often subjected to extensive wear and corrosive environment. Considering the situation, in this article; a hybrid composite was made by integrating MoS_2 and CeO_2 powder in Al 7075 alloy by friction stir processing. The microstructure of the prepared composite was examined by scanning electron microscopy (SEM). The microstructure revealed good distribution of the powders in aluminium matrix. Dry sliding wear performance against WC ball was measured for the composite as well as for the unreinforced aluminium alloy. A significant decrease in friction coefficient of the composite was observed due to the presence of lubricating MoS_2 powder. The worn surfaces were studied using SEM to understand the mechanisms involved in degradation of the surfaces. The oxidation and severe adhesive type of wear in aluminium changed to a combination of abrasive and adhesive type of wear in the composite. The material loss due to wear was measured and the specific wear loss was calculated. The specific wear loss of around 8 10-4 mm3/N-m of the aluminium alloy was reduced to nearly 4 10-4 mm3/N-m by incorporating the micro reinforcement. The potentiodynamic corrosion testing of the specimens was performed in 3.5% NaCl solution and analyzed using Tafel polarization method. The corrosion current density was reduced to 8.18 10-7 A/cm² from 2 10-6 A/cm² of unreinforced alloy. Also, the corrosion potential was increased from -863.962 mV to -672.192 mV due to the addition of hybrid reinforcement. Moreover, the rapid corrosion of aluminium alloy was reduced and secondary passivation due to the presence of CeO_2 was observed. Therefore, it is evident that the wear resistance and corrosion resistance of the Al7075 alloy was improved by addition of MoS_2 and CeO_2 powder.

Keywords: Aluminium matrix composite; MoS2; CeO2; Friction stir processing; Wear; Corrosion