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Effect of 3 and 5 wt. % of WO_3 particulates on the properties of Al5Mg5Zn metal matrix

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Abstract. In this research work 3 wt. % and 5 wt. % of tungsten oxide (WO_3) particulates are reinforced the Al-5Mg-5Zn alloy. Two-step liquid stir casting processing route is used for the development of these particulate reinforced aluminium alloy metal matrix composites. The mechanical and the tribological properties such as Brinell hardness, impact toughness and dry sliding wear resistance of the as-cast Al-5Mg-5Zn alloy matrix and the prepared Al-5Mg-5Zn/WO_3 particulate metal matrix composites are analysed according to ASTM standards. The worn-out surfaces of the test samples during the wear test of the developed compositions are also analysed by using optical microscopy to express the patterns of wear. The results show that the addition of WO_3 particulates improved the hardness as well as dry sliding wear resistance of the Al-5Mg-5Zn alloy and these properties are also increased with the increase in the wt. % of WO_3. The value of impact toughness decreases with the addition of WO_3 particulates as well as increasing the wt. % of WO_3 particulates.

Keywords: metal matrix composite; WO_3; hardness; impact toughness; wear resistance

1. Introduction

In this present era, Metal Matrix Composite (MMC) is an advanced material. The MMCs are fabricated by the macroscopic combination of reinforcement and matrix materials. The MMCs includes a desired combination of tribological as well as mechanical properties (Jones 1998, Kaw 2006, Ozben *et al*. 2008, Patel *et al*. 2020c). Aluminium Metal Matrix Composites (AMMCs) hold a very good strength to weight ratio. The AMMCs are mostly applicable in aerospace and automobiles to reduce the required thrust force and to save the fuels requirement (Chen and Tokaji 2004, Feng *et al*. 2008, Patel *et al*. 2018a, 2020a, Shorowordi *et al*. 2003). In particulate reinforced AMMCs, metal forming processes are also applicable because it provides isotropic property in case of the homogeneously distributed particulates between the matrix (Chen and Tokaji 2004, Karamis *et al*. 2003, Patel *et al*. 2021).

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