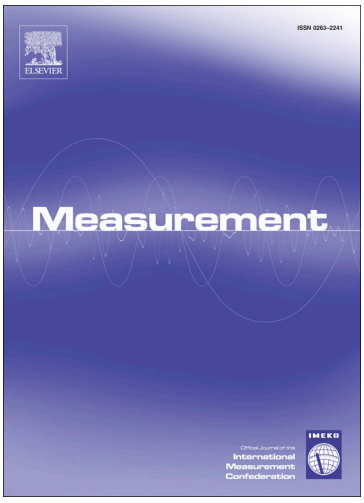

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High stress abrasive wear characteristics of Al 7075 alloy and 7075/Al_2O_3 composite

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Abstract

This paper focuses on the tribo-responses of as-cast Al 7075/Al_2O_3 composite and its unreinforced base alloy under two-body abrasion. Composite prepared by stir casting route shows near uniform distribution of 20 wt.% Al_2O_3 particles in the matrix of Al-alloy. The effects of four control factors *i.e.*, load, SiC abrasive grit size, sliding distance and sliding velocity on three tribo-responses *i.e.*, wear rate, coefficient of friction and roughness of worn surface have been investigated separately for base alloy and composite using pin-on-disc tribometer. Design of test conditions and analyses of output responses have been performed following standard statistical tools of Taguchi orthogonal array, analysis of variance (ANOVA) and regression methods. Composite demonstrates reduced wear rate and lower coefficient of friction, but higher surface roughness as compared to base alloy under all investigated test conditions. The predominant control factor is found to be abrasive grit size followed by load for all tribo-responses except roughness of worn composite surfaces wherein the load plays major role. The optimal combination of control factors of different tribo-responses have been identified considering smaller-is-better approach. Confirmatory tests carried out to validate the developed models yield low errors (8.1-2.6%) exhibiting excellent correlations. Enhanced tribological properties of composite over base alloy has been explained by identification of wear mechanisms through characterizations of worn surface, wear debris and abraded abrasive medium.

Keywords: Aluminum matrix composite; Abrasive wear; Friction; Surface roughness; Taguchi method; ANOVA.

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