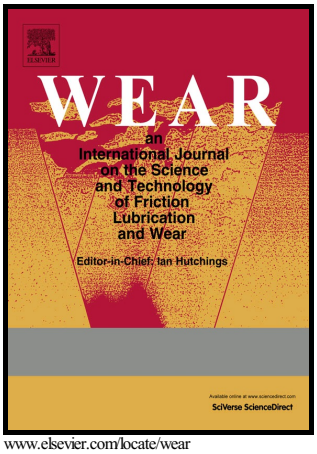

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Friction and Wear Durability study of Epoxy-based Polymer (SU-8) Composite coatings with Talc and Graphite as Fillers

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Abstract:

SU-8, an epoxy-based polymer, is industrially very useful material for fabricating microsystems such as micro-electro-mechanical systems. However, for optimal performance, it is necessary to further improve the mechanical and tribological properties of SU-8. Different weight percentages (wt%) of graphite and talc particles are added to SU-8 for the enhancement of mechanical as well as tribological properties. The composite with the optimized composition of SU-8+15 wt% graphite+15 wt% talc has shown superior properties compared with pure SU-8 and other composites tested. This composite shows ~4 times lesser steady-state coefficient of friction (~ 0.2), ~ 3 times higher elastic modulus (~ 7.97 GPa) and ~ 2 times greater hardness (~ 0.52 GPa) over those of pure SU-8. Also, there is a decrease in the wear rate by ~ 10^3 times. This optimized composite, which showed nano to micron scale texturing on the surface, has performed better in comparison with single or mixed fillers with different wt% ratios. The wear mechanism for filler content up to 10 wt% was found to be fatigue and delamination, whereas for higher filler content the abrasive wear mechanism was dominant.

Key words: SU-8; Talc; Graphite; Composites; Sliding wear

1. Introduction:

SU-8 is an epoxy-based negative photoresist polymer with UV curable property [1]. It is a potentially useful structural material for fabricating micro-electro mechanical systems (MEMS). It is superior to Si in properties such as bio-compatibility and low surface energy. In comparison to Si, fabrication of micro components using SU-8 is very easy and cost-effective [2]. The main issues with SU-8 in engineering applications are its low mechanical strength and poor tribological properties [3-7].

MEMS are very small devices (few to hundreds of microns) with high surface area-to-volume ratios. Currently, they are used in automotive, electronics and other industrial applications.