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Tribological Characterization of Cu-Ni Metal Matrix Composites Using MoS_2 Nano- lubricant

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Abstract: In this study, Cu-5wt.%Ni and Cu-10wt.%Ni two metal matrix of copper having 5%,10% of Ni, reinforced with divergent percentages of titanium carbide (0, 3, 6, and 9wt.%) were synthesized with the help of high-energy ball milling, compaction, sintering. The coefficient friction and wear characteristic were examined at various normal loads of 30N, 60N, 90N, and 120 N, at fixed sliding speed of 0.25 m/s against a harder counter face made of steel, EN8 (HRC 46 - 48) ball under boundary lubrication using a ball-on-disk test equipment. The Cu10wt.%Ni-3TiC composite has a higher value of micro-hardness of 117(HV) and sintered density of 8.036gm/cm^3 at 3wt% of TiC. The wear rate and coefficient of friction have been elaborated on the basis of micro-hardness and presence of nano MoS_2 in lubricant. At 3wt% TiC in metal matrix have optimum performance of friction and wear caused. The wear mechanism of the Cu5Ni and Cu10Ni metal matrix was a combination of adhesive and oxidative wear and composites had mainly abrasive wear.

Keywords: copper-based MMCs; TiC particles; boundary lubrication; Friction; Wear.

1. Introduction

Copper and its alloys contribute as a major part of industrial metals. They are very well-known substance that are versatile used in commercial applications specially in sporting goods automobile, aerospace, and its engineering industrial application is mainly due to their excellent thermal conductivity and electrical property, easier to fabrication, and high strength and resistance to fatigue [1]. Copper-based MMCs are auspicious materials for the reason of their excellent thermo-physical feature. It is also used in various industrial applications, such as, brush materials and torch nozzle, electrical sliding contact (railway overhead current collector systems). Strength of copper can be increased by alloying copper with other elements or by reinforced fine particles in copper based matrix. The reinforced particles may be a ceramic or metal, it may be non-metallic particles, for instance a stable oxide, carbide of metal, etc. added with the copper metal matrix. The benefits of the reinforced particles it work as a strengtheners, which depends on size of particles (finer size is better), particle distribution (good dispersed is preferred), density of particles (high per unit volume will be better), particles gap (closer is better) [2].