Unlocking Tribological Performance of Silver-Infused Cu-Al_2O_3 Self-Lubricating Cermet

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Abstract

This study investigates the tribological properties of cold-sprayed (CS) coatings comprising Cu, Cu-Al_2O_3, and Cu-Al_2O_3-Ag at room temperature and under high-temperature sliding conditions. The composite coatings feedstock maintained a constant 50 vol.% Al_2O_3 concentration, while Cu-Al_2O_3-Ag had Ag infused at 5 and 10 vol.%, maintaining an overall 50 vol.% of metallic content. Dry sliding tests using Al_2O_3 pins were carried out at 25°C and 450°C to study the tribological performance of the coatings. While the inclusion of Ag notably decreased the coefficient of friction (COF) at elevated temperatures, no distinct trend in COF was observed for the tests conducted at 25°C. The composite coating containing 5 vol.% Ag exhibited superior friction and wear performance at 25°C and 450°C. The addition of Al_2O_3 enhanced the coating hardness. However, incorporating a higher amount of Ag reduced the Al_2O_3 retention during CS and, subsequently, the hardness of the coating. The study delves into the role of Ag in the retention of ceramic particles during the CS process and the mechanisms underlying the enhanced self-lubrication performance of the cermet coatings.