Influence of coating thickness and interlayer on tribological behaviour of MoSx-WC based coatings

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MoS₂ is a broadly accepted solid lubricant for space mechanisms. However, a drawback of MoS₂ is its tribo-sensitivity to atmospheric water vapor which renders the film unsuitable for use under high humidity levels at air conditions. This recommends precautions during ground qualification testing and storage of solid lubricated space mechanisms. Recently, coupling a need of extending space mechanisms life with advances made in PVD technology, efforts have been made in developing more wear resistant MoS₂ and low friction films capable of both: vacuum and atmospheric application. Alloying the MoS₂ films with metals has been reported by several researchers with varying success. The authors have already reported the tribological behavior of MoSₓ solid lubricant film alloyed with WC under different environments. In this work different MoSₓ-WC coatings were synthesized by direct magnetron sputtering on silicon and 440C stainless steel substrates using MoS₂ and WC targets in an argon atmosphere. Different coatings were produced varying the interlayer (thickness, gradient interlayer, etc.) and total film thickness (from 1.6 to 3.2 microns). Coating morphology by scanning electron microscopy (SEM), hardness, adhesion and tribological properties were studied. Pin on disk test under 10% RH. at 0.75 GPa showed the highest endurance when interlayer was in the range of 0.2 microns with durability up to 450,000 wear cycles with average friction coefficient as low as 0.07. When studying total coating thickness, it was observed higher coating endurance in case of thicker coating.

Keywords
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solid lubricant
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