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Tribological behaviour of MoSx-WC based coatings at cryogenic temperatures

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MoS_2 is widely accepted solid lubricant for space mechanisms. However, a drawback of MoS2 is its tribo-sensitive to atmospheric water vapor pressure which renders the film unsuitable for use under hight humidity levels at air conditions. This recommends precautions during ground qualifcation 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 MoS_2 and low fricition films capable of both: vacuum and atmospheric application as well as able to lubricate mechanisms in a wider temperature range than liquid lubricants. Alloying the MoS_2 films with metals has been reported by several researchers with varying success. The authors havealreadyreported the tribological behaviour of MoSx solid lubricant film alloyed with WC under different environments at room temperature.
In this work MoSx-WC coatings were synthesized by direct magnetron sputtering on silicon, 440C stainless steel and Ti6Al4V-ELI substrates using MoS2 and WC targets in an Argon discharge. Different coatings were produced varying the total film thickness (from 1.2 to 2 microns). Coating morphology by scaning electron microscopy (SEM) hardeness adhesion and tribological properties under 10% RH, vacuum conditions and at 80K under vacuum conditions. The MoSx-WC coatingunder vacuum shows different behaviour when tested at 80K and at room temperature, but still much lower than in unlubricated tests. Besides, there is no effect on the tribological proerties of the coating after being inmersed at 80 K in vacuum conditions.

Keywords
solid lubricant
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