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EFFECT OF FILM THICKNESS ON THE STRUCTURAL AND TRIBO-MECHANICAL PROPERTIES OF REACTIVE SPUTTERED MOLYBDENUM NITRIDE THIN FILMS

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Abstract

The current study aims to examine the impact of nitrogen content and film thickness on the structural and tribo-mechanical characteristics of reactive sputtered MoN thin films. Molybdenum nitride thin films with thicknesses ranging from 0.2 to 1.25 m have been applied to steel and silicon substrates for this purpose, with various amounts of controlled atmosphere ($Ar+N_2$). Then, the films are characterized using XRD (X-ray diffraction), EDX (energy dispersive X-ray analysis), SEM (scanning electron microscopy), FTIR (Fourier-transform infrared spectroscopy), and nanoindentation. The residual stress was measured using the Stoney formula. Results show that a high compressive residual stress of -5.7 GPa is present in the film with a 0.3 μm thickness and gradually decreases with increasing film thickness. Above 1 μm of film thickness, there is no change in the density of the MoN films. Also, the coating hardness and Young's modulus vary between 9.5 and 35 GPa, and 266 and 320 GPa, respectively, depending on nitrogen content and film thickness. Lastly, the friction of the MoN thin films is estimated to be around 0.55, which proves that the oxide is being slowly removed.

Keywords: reactive sputtered MoN films; atmosphere content; film thickness; FTIR spectroscopy; tribo-mechanical properties.

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