Structure, composition, and mechanical characterization of dc sputtered TiN-MoS_2 nanocomposite thin films

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TiN-MoS_2 composite thin films deposited by dc magnetron sputtering with MoS_2 concentrations from 3 to 40 at.% were investigated. The elementary composition and the formed compounds were determined before and after wear. The crystalline structure of the composite thin films was accessed and the nature and concentration of the precipitates in the TiN matrix were imaged by transmission electron microscopy. The hardness and elastic moduli of the films were measured by nanoindentation and the elastic strain to failure calculated on the basis of these two magnitudes. The MoS_2 formed in the composite coatings during thin film co-deposition are nanoscopic in size, homogeneously distributed, and mostly amorphous, although part of them are crystalline. The present study does not confirm MoS_2 formation at grain boundaries or TiS formation by substitution of S for N in the TiN matrix. The hardness and elastic strain to failure are appreciably high for the present TiN-MoS_2 thin film composite coatings with MoS_2 concentrations up to 4%. The potential applications are discussed on the basis of these findings.

Keywords: Thin films, TiN-MoS_2, Nanostructure, Nanoscopic clusters

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