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Synthesis and tribological properties of WSex films prepared by magnetron sputtering

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WSe_x films with variable Se/W ratio were deposited by non-reactive r.f. magnetron sputtering from WSe_2 target changing the applied d.c. pulsed bias conditions and substrate temperature. The structural and chemical properties were measured by cross-sectional scanning electron microscopy (X-SEM), energy dispersive analysis (EDX), Raman and X-ray photoelectron spectroscopy (XPS) .The tribological properties were measured in ambient air(RH=30-40%)and dry nitrogen by means of a reciprocating ball-on-disk tribometer. A clear correlation was found between the Se/W ratio and the measured friction coefficient displaying values below 0.1 (in ambient air) and 0.03 (in dry N_2) for ratios Se/W≥1 as determined by EDX. An improvement of the wear resistance and hardness properties was pursued by incorporating WC nanocrystals in the WSe_x matrix using WC as a second target. The results demonstrated that remarkable tribological results could be obtained even in ambient air (friction ≤ 0.07 and wear rate »10^{-7} mm^3/Nm) by controlling the film microstructure and chemical composition without needs of forming the nanocomposite WSe_x/WC. The excellent tribological properties were attributed to the presence of layered WSe_x and its oxide, WO_3, in the counterfaces as demonstrated by Raman analysis of the counterfaces.

Keywords
WSe2
friction
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