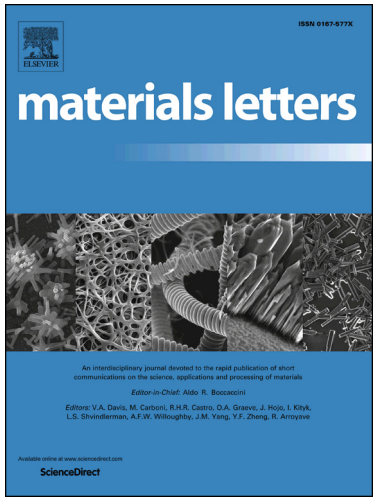

A simple strategy to tailor the microstructure and wear-resistance of sputtered WS_2 films

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A simple strategy to tailor the microstructure and wear-resistance of sputtered WS_2 films

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Abstract

Sputtered WS_2 films can be modified by adding some amount of hetero-elements to overcome the porous columnar microstructure and thereby to enhance the wear resistance. However, the recession of tribological properties of WS_2-hetero-element composite films in low earth orbit environment would be a potential danger because most hetero-elements succumbed to oxidation by atomic oxygen. Herein, by altering deposition argon pressure to adjust the plasmas bombard function on growing WS_2 film, the characteristic porous microstructure disappeared. At the optimization condition, the sputtered WS_2 film exhibited a dense microstructure, high ratio of S to W, and thereby much better wear-resistance. However, the excessive bombardment would result in the prominent loss of S atoms in WS_2 film and the deterioration of tribological properties.

Keywords: Physical vapour deposition; Thin films; Structural

1. Introduction

Tungsten disulfide (WS_2), as one of earth-abundant transition metal dichalcogenides (TMDs), has potential applications as energy material [1], catalyst [2] and lubricant [3] due to its special layer structure. Its unique physical, chemical and mechanical properties all mainly depend on its microstructure. On the application aspect of the catalysis and energy storage efficiency of WS_2, the high porosity and