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Abstract

Layered transition metal dichalcogenides (TMD) such as WS_2 are materials well-known for their solid lubrication properties [1]. However, the lubricating property degrades through oxidation or moisture and it is also limited by its low hardness and low load-bearing capacity. In contrast amorphous diamond-like carbon (DLC) films are reported to have many features that contribute to excellent tribological characteristics, such as high hardness, anti-wear property with both low friction coefficient and low wear rate[2]. The present research aims at depositing WS_2/a-C nanocomposite coatings by magnetron co-sputtering method. The effects of carbon content and argon flow rate on the microstructure and mechanical performance were investigated. The WS_2/a-C nanocomposite tribocoating was scrutinized by electron microscopy and mechanical testing. Transmission electron microscopy reveals feathery WS_2 platelets, randomly distributed in the amorphous carbon matrix. The nanocomposite coating turns out to be more amorphous-like with increasing carbon content. Nanoindentations tests show that the hardness and elastic modulus of the coating increase with increasing carbon addition while decreasing with a higher argon flow from 10 sccm to 25 sccm.

Ball-on-disk tribotests (100Cr6 steel ball as a counterpart) show that the coefficient of friction can be as low as 0.017 in a dry environment (5% relative humidity). It reaches 0.15 in a high humidity surrounding and remains stable within 20000 sliding cycles.

References:

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