Tribological Behaviour of MoS2/Au Coatings

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Abstract

MoS2 has been widely used as a solid lubricant to reduce friction and wear of machine elements, especially operating in vacuum and inert gas environments. The endurance of a MoS2 solid lubricant film is related to its density and good adhesion to the substrates. Recently, a fully dense and well bonded MoS2-Ti (MoST) film has been developed by using an advanced sputtering system. It is found that the wear life can be significantly improved even under high humidity environment. This study aims to enhance the endurance of MoS2 coating by applying a thin layer of Au (~ 80 nm) on MoS2 surface. The pin on disc wear test was performed at an applied load of 40 N (using 5 mm WC/Co as a ball) and high relative humidity (~ 45%). Experimental results show that the addition of Au film increases the endurance of MoS2/Au over equivalent coatings without Au. A relatively high coefficient of friction (~ 0.15) was measured in the initial sliding at the applied load of 40N. The friction coefficient rapidly decreases to a stable value (~ 0.045) after about 100 cycles sliding. After more than 15000 cycles, the friction coefficient gradually increased to a second stable value (~ 0.15). An average endurance of over 50000 cycles was measured in this case. It is believed that both intrafilm plastic flow within orientated MoS2 and Au-MoS2 composite layers, and interfilm sliding between the Au-MoS2 composite wear debris dominate the friction process. The Au or Au-MoS2 composite layer can effectively prevent oxygen or moisture reaction with MoS2 and hence significantly increases the wear life.

Keyword：Tribology; MoS2/Au; intrafilm plastic flow