Microstructure and tribological characteristics of binary refractory metal nitride coatings

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Abstract:

This study focused on microstructure evolution and mechanical behavior of binary refractory metal nitride systems films, including (MoHf)N, (WHf)N and (MoW)N. The phase, adhesion, and wear behavior variations were discussed in terms of material selection. With a radio frequency, RF, magnetron dual gun co-sputtering system, the binary refractory metal nitride thin films were fabricated at a fixed Ar/N_2 inlet gas ratio of 12/8 sccm/sccm. The structure of (MoHf)N thin film exhibited MoN, Mo_2N, and MoN_2 phases, while the (WHf)N thin film possessed WN and Hf_4N_3 phases. As for the (MoW)N thin film multiple phases including WN, MoN, and Mo_2N were observed. The (MoW)N and (WHf)N possessed adhesion level of HF3 and HF4, respectively, indicating a poor adhesion due to the exist of tungsten element. On the other hand, (MoHf)N thin film showed an index of HF2. The wear results reflected a similar trend, For the (MoHf)N coating, the track maintained a smooth surface and the film kept intact after a wear length of 100m. On the contrary, the wear tracks of (MoW)N and (WHf)N coatings showed cracking and pealing after the wear test, indicated a weaker tribological behavior.

Keywords: Microstructure; Refractory metal nitride; Multiple phase; Adhesion; Wear.