Influence of high-power pulse magnetron sputtering tantalum nitride film characteristics and protection behavior

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Abstract

Nowadays quality requirements, such as higher hardness, wear resistance, sufficient toughness, adhesion strength and so ow, are focused for transition metal nitride, TMN, hard coating field. The selection of coating among various possible materials and related manufacturing processes is quite a challenge and requires careful consideration on the functions in the development systems. Among TMNs, with high hardness excellent tribological behavior, thermal and electrical performance, TaN. Has been chosen as a good protective layer for working components in versatile applications. In this study, and the enysfalline and metastable amorphous phase of tantalum nitride are fabricated using radio frequency, r.f., reactive magnetron sputtering technique. A multilayer film formed by alternating stacking of the above mentioned crystalline/amorphous layers is deposited through input power and gas inlet control. The adhesion of the tantalum nitride film is studied and compared with controlling parameters of interlayers with changes thickness, r.f. power, and high intensity power plasma. Compared with r.f., the single-layer film has a compact structure due to the higher energy of plasma power. The higher energy deposition, improves the crystallinity, and lead to a larger grain size. At the same time, the surface roughness of the film is reduced, and the hardness and Young's modulus are improved. The multilayer film is manufactured through the crystalline/amorphous stacking, the hardness and Young's modulus and wear resistance are superior than those of the single-layer film.

. **Keywords :** HiPIMS, sputtering, TaN, multilayer