Influence of Ta content on properties of TiAlTaN films

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Binary and ternary nitrides of transition metal elements, such as Ti, Cr, Zr, V, Nb, or Ta, exhibit outstanding mechanical, chemical, and thermal properties, and are utilized as protective coatings in machining, automobile and other industrial areas. Recently, alloying titanium aluminium nitride (TiAlN) with tantalum can improve cutting performance. Titanium aluminium tantalum nitride (TiAlTaN) films have been reported on improved mechanical and tribological properties.

In this work, a series of TiAlTaN films with different Ta contents were deposited using an ion beam assisted deposition. Microstructure of the as-deposited films was characterized by using X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and scanning electron microscope (SEM). Mechanical properties of the TiAlTaN films were also tested. Tribological behavior and corrosion performance of the TiAlTaN films were analyzed and compared to that of the TiAlN film. Results show that the TiAlTaN films demonstrated better mechanical properties, tribological behavior and corrosion resistance than the TiAlN film. Ta content has a great influence on the properties of the TiAlTaN films.

Key words: TiAlTaN, Ta, Nano-hardness, Corrosion performance.