
The effect of element content on structure and mechanical properties

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Abstract

The TaNbTiWN multi-element films are prepared by combining of magnetron sputtering deposition and nitrogen plasma based ion implantation (N-PBII). The composition, structure and mechanical properties of the films are investigated. For high Ta and Nb content, the alloy films TaNbTiW are composed of HCP and BCC structures. When the contents of Ta, Nb, Ti and W are close to equiatomic, the alloy films exhibit two types of BCC structures. For low Ta and Nb content, the alloy films consist of a single BCC structure. Whereas all the TaNbTiW films are composed of BCC and FCC structures after N-PBII treatment. The lattice constant increases for both the BCC and FCC phases with the decreasing of the content of Ta and Nb in the films. The hardness and modulus of the films are improved with increasing nitrogen implantation dose and reach maximum values of 9.0 and 154.1 GPa, respectively.

Keywords: TaNbTiWN films, magnetron sputtering deposition, PBII, structure, hardness

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