

Effects of metal dopant content on mechanical properties of Ti-Cu-N films

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*Abstract*

TiN coatings were applied for various application fields, because of a good wear-resistance and a high hardness. Typically, TiN thin films show the hardness of 25GPa and friction coefficient of 0.6. However, in many field, one is looking for a more improved tool which has low friction coefficient and high wear resistance.

The main motivation of this study is to characterize the influence of copper dopant content on TiN thin films. Ti-Cu-N thin films were deposited onto D2 steel substrates by PVD processing with various magnetron current densities (Cu contents). In this work, we synthesized titanium nitride films similar with reported typical titanium nitride films and synthesized Ti-Cu-N thin films with the addition of elemental copper which is measured improved hardness more than pure TiN films with copper content variables. This films has preferred oriented films of (111) direction.

In addition, It was found that there is a strong correlation between content of various metal and film characteristics such as preferred orientation, grain size, hardness and friction coefficient and so, in future study, improved mechanical properties of TiN films can be controlled by change in target current density.

The Ti-Cu-N film will show apparent hardness improvement and mechanical properties enhancement, when doping element is added onto TiN thin films.

Film structure, chemical composition, mechanical properties were investigated by means of X-ray diffraction(XRD), scanning electron microscopy(SEM), transmission electron microscopy(TEM), energy dispersive spectroscopy(EDS), wear resistance tester and nanohardness tester.