

Abstract

The work presented in this thesis addresses the deposition of titanium oxy-nitride thin film using conventional 2.3kJ dense plasma focus device. This work is motivated by remarkable properties of TiOxNy thin films which are being used in thin film resistors, solar selective collectors, biomaterials and decorative coatings. Properties of the oxy-nitride depend significantly on the N/O ratio in deposited films. The production of these films using different deposition techniques have been reported earlier but the use of plasma focus technique is one of the prospective hybrid deposition method which is not only economical, simple, efficient but also provide high deposition rate and good adhesion in less time compared to other available thin film synthesis techniques.

The composite films are characterized by employing different characterization techniques such as XRD, SEM, EDS and Vickers micro-hardness tester to explore the diverse surface properties (crystal structural, surface morphology, microstructure features, elemental compositions and surface micro-hardness) of the composite films.

Deposition of titanium oxy-nitride thin films by employing the energetic ions emanated from plasma focus device for multiple focus shots, when the samples are placed at zero angular position and 9cm away from titanium target, is confirmed by the formation of different phases of titanium nitride and titanium oxide films on aluminum substrate. Concentrations of oxygen and nitrogen were varied systematically to observe the effect of oxygen content on film properties. At first sample was treated without oxygen and then oxygen was injected for other samples and oxygen ratio was increased. Films were crystalline in nature confirmed from XRD results. Dense closely packed uniform structures were observed for less oxygen content but with increase in oxygen content film were seen to become rough and porous. EDX results were used to get elemental composition of films deposited on each sample. Micro hardness test revealed decrease in hardness of deposited layer with increase in oxygen content. Hence it was observed that different features of sample are strongly related with amount of oxygen used during deposition process and it influences film properties.