Abstract

CrN, TiN thin films thin films were prepared employing Closed Field Unbalanced Reactive Magnetron Sputtering. The deposition was carried out in a high vacuum system consisting of the cylindrical deposition chamber equipped with two targets located at diametrically positions. The substrate holder is located at the centre of the deposition chamber and it has rotation capability in three discrete values of rotation speed. X-Ray techniques (XRD and XRR) were employed for the structural and morphological characterization respectively. Spectroscopic ellipsometry was employed for the optical characterization using the combined Drude-Lorentz and Tauc-Lorentz model.

CrN and TiN thin films were deposited at various values of N_2 flow (reactive gas) and substrate bias voltage. The substrate bias voltage was found to affect the preferred growth orientation, the cell size, the internal stress field and the density of the thin films, since it affects the mobility of the adatoms on the surface of the growing film and the subplantation conditions of the plasma ions during thin film growth. More specific the [100] orientation is favoured when the mobility of the adatoms is increased due to the increase of energy transferred to the growing film during the ion bombardment. Contradictory, when the energy which is transferred to the surface of the growing film is decreased due to either the decrease of energy of the ions or the dissipation of the ions' energy in to the bulk of the film the [111] orientation is favoured. Furthermore, the cell size of the films increases with bias voltage, since the number of the plasma ions subplanted increases and consequently increases the lattice deformation.

Optical characterization of CrN thin films, revealed the relationship between structure and morphology on one hand and the relationship between optical and electronic properties on the other hand. Thus, Cr_2N seems to have a metallic character while on the other hand CrN seems to be a semiconductor.

In the case of TiN the results of optical characterization showed that the optical parameters calculated from the Drude – Lorentz model, follow the whatsoever referential dependence from the plasma conditions during the deposition of the films.

Finally, an indirect calculation of the energy gap, using Tauc plots, permitted the calculation of the observed colors of the TiN thin films. This procedure permits the determination of the deposition conditions in order to obtain the desired color for using in decorative applications.