Abstract

Indium nitride (InN) thin films are deposited by using pulsed DC magnetron sputtering technique on glass substrates. The power range is varied from 100 W to 150 W. The structural evaluation of deposited films is carried out by utilizing X-ray diffraction (XRD). The result of XRD spectra disclose polycrystallinity of InN peaks having preferred orientation towards the c-plane. The sputtering power is increased from 100 W to 130 W, consequences the significantly improved crystal quality of InN. Though, with additional upsurge in the power up to 150 W, there is reduction in crystallinity of the film. The morphological analysis of the results from SEM indicates agglomeration of minor grains into greater ones through the increase of the power. The variation is observed in the band gap and electrical resistivity of InN films, with changing sputtering power. These results are found to be associated with variations in the crystallinity of InN at various sputtering powers. In order to support our results, the optical properties of InN films have also been calculated by the first principle method to support our results about disparity in band gap. The deposition of InN films on Si (100) substrates by using pulsed DC magnetron sputtering was performed. Effects of varying sputtering power and Ar-N_2 flow ratio on the structural, morphological, and optical properties of indium nitride (InN) films were investigated. The structural characterization indicated nanocrystalline InN film with preferred orientation towards (101) plane that exhibited the optimum crystalline quality at 130 W and for 40:60 Ar-N_2 ratio. The surface morphology of InN as observed through FESEM contained irregular shaped nanocrystals with size that increases with higher sputtering power and Ar: N_2 flow ratio. The evaluation of optical properties of InN films is carried out at room temperature using ellipsometer. The band gap of InN was decreased with the increase of sputtering power to 130 W whereas an increase in the band gap was noticed with increase of the Ar: N_2 flow ratio.

Thin films of Aluminum nitride (AlN) with precise oxygen content are fabricated on silicon substrates. The effect of structural variation upon the optical properties is studied. The dependency of film morphology on the deposition process parameters is also studied. Mixtures of argon (Ar) and nitrogen (N_2) gases are used to sputter AlN target in RF magnetron sputtering system. The variation of refractive index ranging from 1.6 – 2.0 at

400 nm is studied by regulating the sputter gas (Ar and N_2) flow rate ratio. The consequential refractive indices are linked with oxygen content and density of the AlN thin films. A Distributed Bragg Reflectors (DBR) is fabricated and adjusted for ultraviolet-A reflectivity by alternating the pairs of AlN thin films using a noticeable combination of *low-n* and *high-n*. The optical properties of DBR is studied. The structural transformation outcomes in the DBR stack on the performance of the device is deliberated. The DBRs show a negligible extinction coefficient (*k*) along with the exploiting control of oxygen amalgamation with a single sputtering target.

Deliberating to the demand for high-performance silver-based telescope mirrors, efforts are being made to develop surface coatings that guard the mirrors from deterioration. Aluminum nitride (AlN) is utilized for numerous optical coatings. It is an important well-suited, candidate for silver-based mirror protective coatings due to its high optical transparency and mechanical toughness. Nevertheless, conferring to our best information, AlN with controlled oxygen content has never been used as a protector for silver mirrors. In this study, various AlN protective coatings are deposited by utilizing RF magnetron sputtering system. Explicit controlled amounts of oxygen are deliberately announced to get protective layers with various refractive indices ranges from 2.1nm to 1.6 nm (i.e., high ~2.1, medium ~1.8, and low ~1.6 at 400 nm). The intended AlN protective layers are applied to two types silver mirror structures, having two different antioxidation layers. The performances of mirror structures are evaluated in relation of optical reflectivity and structural analysis. The environmental testing is applied in a controlled atmosphere at 80C with ~80% relative moisture. Complete investigation on the mirror samples before and after the environmental testing specifies that AlN-based protective layers with medium refractive index performed best in comparison with AlN having higher or lower refractive index. Furthermore, the thicker AlN protective coatings with medium refractive index are best for the protection of silver mirrors according to figure of merit. We recommend that the advantages of the best AlN barrier coating with specific refractive index are probably allied with the exclusive optical, chemical, and structural features based on an exceptional nitrogen/oxygen ratio.