

Abstract

The Cadmium Oxide (CdO) films were deposited on silicon substrate by using Pulse Laser Deposition (PLD) technique under various oxygen gas pressures and substrate temperatures ranging from 1 to 15 Torr and Room Temperature (RT) to 300°C respectively. In order to explore the effects of ambient gas pressure on energy and flux of ablated species, Faraday cup (FC) measurements were performed. The FC measurements reveal that both energy and flux of Cd plasma species decreases with the increase of oxygen gas pressure. The surface morphology of deposited films was investigated using Scanning Electron Microscope (SEM). The films deposited at RT for various oxygen pressures exhibit varying degree of formation of fiber-form fuzz like structure. The density and size of fuzz structure depends upon oxygen pressure as well as the formation of CdO phases. The films deposited at 5 Torr pressure at 100°C exhibited the morphology transformation of fiber form fuzz like structure to spherical particulates. The decrease in the density of particulates and pore formation were detected with increase in substrate temperature. The X-ray Diffraction (XRD) examination demonstrates deposited films are polycrystalline in nature having both Cd and CdO phases with preferred orientation along Cd (103) phase. The structural parameters, growth of oxide phases, diffraction peaks intensity and position are significantly influenced by oxygen pressures and substrate temperature. The crystallinity of deposited films decreases with increase in oxygen pressure whereas, increases with increase in substrate temperature. The deposited films were characterized for electrical resistivity by employing four probe point method. The electric properties of films deposited under different oxygen pressure were described by the growth of CdO phases. The growth of CdO phases is responsible to increase the electrical resistivity of deposited layer. Whereas, the electrical properties of films deposited at different substrate temperature was mainly correlate with the variation in crystallite size. Vickers hardness test was employed for determining the films surface micro hardness. The anomalous trend in the modification of surface hardness of CdO films with rise in gas pressure has been observed. However, an overall decrease in surface hardness was detected for the films deposited at higher substrate temperatures.