Abstract

The effect of substrate temperature, on structural, morphological, optical and electrical properties of pulsed laser deposited copper oxide thin films has been investigated. Nd-YAG laser (532 nm, 6 ns, 10 Hz) at a fluence of 8.2 J/cm^2 was employed for deposition of copper oxide thin films on silicon (400) substrate. XRD analysis reveals that copper oxide films deposited at 25°C are amorphous in nature, whereas films deposited at higher substrate temperatures are polycrystalline in nature, with the formation of both phases of Cu_2O and CuO. Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) analyses, revealed that films deposited at substrate temperatures, ranging from 25°C to 300°C are comprised of large sized clusters, islands and particulates, whereas uniform films with an appearance of granular morphology and distinct bump formation are grown at higher substrate temperatures of 400°C and 500°C. The thickness of the deposited films was measured using M-probe system, and it reveals that the thickness of the deposited film decreases with increase in substrate temperature. The optical band gap of deposited films is evaluated by UV-VIS spectroscopy and it shows a decreasing trend with increasing substrate temperature. Four point probe analysis reveals that electrical conductivity of the deposited films increases with increase in the substrate temperature, and is maximum for highest growth temperature of 500°C. It is revealed that growth temperature plays a significant role for structure, texture, optical and electrical behavior of copper oxide thin films. The surface and structural properties of the deposited films are well correlated with their electrical and optical response.