

ABSTRACT

Nitrogen ions implantation effects on Copper Oxide (CuO) film are investigated in this work. The CuO films were deposited on Si substrate by DC magnetron sputtering of copper target in the mixture of argon and oxygen. Nitrogen ions (N^+) were implanted in the film using Pelletron Tandem Accelerator at 5×10^{12} , 5×10^{13} and 5×10^{14} ions/cm², while maintaining the constant ion energy. The characterizations of untreated and nitrogen ions implanted films were made through x-ray diffraction (XRD), field emission scanning electron microscope (FESEM), four probe method, and ultraviolet-visible spectroscopy techniques. The results obtained from the XRD revealed only CuO (-111) peak in all specimens. After N^+ implantation till 5×10^{13} ions/cm², the CuO peak was shifted to higher diffraction angle, whereas, the peak was shifted back at lower angle on increasing the dose to 5×10^{14} ions/cm². Initially, the crystallite size was reduced due to ions implantation at 5×10^{12} ions/cm², and then it increased with further increase of the ion dose. The FESEM images showed a decrease in the grain size of the film at 5×10^{12} ions/cm² and then its increase at higher doses. The decrease in grain size at lower dose was attributed to the oxygen vacancies produced due to ions implantation. While at higher doses, localized thermal spike improved the structural ordering of the film through annihilation of defects. The electrical resistivity was measured using four probe technique. The resistivity of CuO was decreased on nitrogen ion implantation at 5×10^{12} ions/cm² and then increased with further increase of the nitrogen dose. The band gap of the CuO followed the same trend as that of its resistivity and crystallite size. The structural, optical and electrical properties of the film were correlated to each other to demonstrate the results.