ABSTRACT

This work deals with fabrication and characterization of a visible light sensitive metal-semiconductor (MSM) photodetector based on copper oxide film. The copper oxide film was deposited on Si (100) by direct current magnetron sputtering of pure copper target in Ar-O_2 plasma at room temperature. Before the fabrication of MSM photodetector, the film was characterized by different techniques such as X-ray diffraction (XRD), field emission scanning electron microscope (FESEM) and UV-visible spectroscopy. The XRD pattern showed a well-defined cupric oxide (CuO) peak oriented along (-111) plane. The average grain size of the film was found to be 30 nm as revealed by FESEM image. The UV-visible spectroscopy revealed the absorption edge of the copper oxide film at 512 nm. In order to fabricate the MSM photodetector, Nickel contacts were deposited on the copper oxide film with a finger shaped mask having interdigitated electrodes by using thermal evaporator system. The photodetection response from the device was investigated by exposing it to lights of different wavelengths such as 365 nm, 405 nm, 505 nm and 850 nm. The current-voltage and current-time measurements of the MSM device were recorded. The results of photodetection indicated a remarkable increase in the photocurrent of the device when exposed to 505 nm light whereas the increase in current at other wavelengths was insignificant. The increase in photocurrent at 505 nm was attributed to the generation of electron-hole pairs in copper oxide film by the incident light. The current-voltage characteristics of Ni/CuO/Ni device revealed Schottky contacts both in the forward and reverse directions due to Fermi-level pinning at the metal-semiconductor interface. The current-time repeatability measurements showed an increase in the percentage sensitivity and current gain of the device with increase of the bias voltage. The maximum current gain and sensitivity and responsivity values at 7 V were recorded to be 3.4×10^1 and 3.2×10^3 % and 1047 mA/W respectively. The photodetector exhibited a fast response to the visible light with rise and fall time of 302 and 232 ms respectively at 7V. These parameters indicated a high performance of the fabricated device.