ABSTRACT

Metal oxide semiconductor gas sensors are utilized in a variety of different roles and industries. They are relatively inexpensive compared to other sensing technologies, robust, lightweight, long lasting and benefit from high material sensitivity and quick response times.

This study consists of two parts; the first part is the preparation and study of the physical, optical and electrical properties of n-PSi and Cu_2O/PSi thin layers. The second part involves the preparation and manufacturing of a gas a sensor device based on the optimal properties of thin films prepared in the first part and studying the sensitivity, response time and recovery time of the device.

The PSi was introduced as a substrate by Photoelectrochemical etching, the current density is changed (10 mA/cm^2 and 20 mA/ cm^2) and etching time is (10 min). The copper oxide was deposited on the n-PSi by Pulsed Laser Deposition technique using pure copper.

The structural properties were studied by X-ray diffraction (XRD) method. All thin films were found to have multi-crystalline and cubic structures. The diffraction peaks of PSi located at $2\theta = 69.18^\circ$ and 69.22° correspond to (400) plane in the preferred direction. In the case of Cu_2O/PSi, the peaks were located at $2\theta = 33^\circ$, 46.1°, 56.4°, 61.75° correspond to (111), (200), (211), (220) planes respectively.

The surface morphology was studied by using atomic force microscope (AFM) and field emission scanning electron microscope (FE-SEM), optical properties are also studied by using photoluminescence measurements.

The properties of the Cu_2O /PSi gas sensor when exposed to (3%) CO_2 gas at different temperatures, obtaining a sensitive sensor at room temperature reached to (290%) and the best operating temperature was (100 ° C) with sensitivity value equal to (303%) at (10 min, 20 mA/ cm^2).