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Gas Response of Tin Oxide Film Sensor to Varying Methane Gas Concentration

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This study was aimed to determine the effect of methane gas concentration on the voltage response of tin oxide (SnO) film. The sensing circuit of the tin oxide film was interfaced to a laptop computer throug an arduino microcontroller for data acquisition. Real time data table and graph can be visualized on the laptop screen during the gas sensing process.

The sensor was enclosed in an airtight plastic jar container connected to a gas source and a water trap that maintained atmospheric pressure in the chamber. A mixture of 1% methane in helium was introduced into the chamber at a rate of 2 liters per minute (LPM) using a mass flow controller. The gas mixture was introduced intermittently at several stages. Each stage was followed by a standby stage during which there was no gas flow and the sensor was allowed to equilibrate with the gas mixture. It was observed that during the introduction of gas at each stage the voltage output of the sensor was increasing. During the standby stage there was no observed change in the voltage output as indicated by a flat response in the graph of voltage output versus time. The added quantity of gas can be computed from the flow rate and time duration of each stage. The incremental concentration of gas was also computed after each succeeding stage.

The computed concentration in parts per million (ppm) was plotted with the measured voltage output per stage. Results showed a linear relationship between gas concentration and voltage output in the range of 3.75 to 7.8 ppm with a linearity of 0.99 and sensor sensitivity of 140 mV/1000 ppm. The sensitivity and linearity were 161 mV/1000 ppm and 0.98, respectively in the range 1000 to 9000 ppm. It is recommended to conduct more trials at different concentration ranges, different methane input mixture percentages, and different flow rates.

Keywords: tin oxide, sensor, methane, gas concentration, gas response, sensitivity

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