UNIVERSITI TEKNOLOGI MARA

CHARACTERIZATION OF NANOSTRUCTURED ZINC OXIDE THIN FILMS FOR AMMONIA GAS SENSOR

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of the requirements for the degree of
Master of Science

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AUTHOR'S DECLARATIONS

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

This research is carried out to deposit and characterizes nanostructured Zinc Oxide (ZnO) thin film by radio frequency (RF) magnetron sputtering method for ammonia (NH_3) gas sensor application. The sensitivity of sensor is mainly depends on the surface reaction effect which strongly depends on the grain size or the surface to volume ratio of the active materials used. Therefore to achieve a highly sensitive NH_3 sensor that works at room temperature, nanostructured ZnO thin films were deposited. Two types of substrate materials namely glass and thermally oxidized p-type silicon (SiO_2/Si) were investigated to determine which substrate material is more suitable for NH_3 gas sensor application. The selection of the substrate materials is based on the structural and electrical properties as well as the response of ZnO thin films under the exposure of NH_3 gas. This study suggested that SiO_2/Si is the most suitable substrate for NH_3 gas sensor application since it produced smaller ZnO grain size and exhibit the change in resistance when exposed to NH_3 gas. In order to obtain the high sensitivity NH_3 gas sensor, the study on the effect of RF magnetron sputtering parameters to the properties of ZnO was performed. The parameters that have been studied were the substrate temperature and the oxygen flow rate. This part of study recommended that the deposition at room temperature with 40 sccm oxygen flow rate gave the lowest grain size (16.62 nm) which in turns reveals the highest sensitivity (94%) towards NH_3 gas.

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