UNIVERSITI TEKNOLOGI MARA

THE ELECTRICAL CHARACTERISTIC OF NANOSTRUCTURED ZINC OXIDE THIN FILMS FOR AMMONIA SENSOR APPLICATIONS

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ABSTRACT

The nanostructured Zinc Oxide (ZnO) thin films have been synthesized using sol-gel method. The ZnO thin films have been deposited on the glass substrate by using the spin coating technique. The ZnO thin films were annealed at 500°C temperature for five different annealing times. The Field Emission Scanning Electron Microscopy (FESEM) and Scanning Electron Microscopy (SEM) were used to examine the surface morphology and particle of the deposited ZnO thin films. The thin films electrical characteristics were investigated using the current – voltage (I–V) measurement to analyze the conductivity and resistivity behaviour of the thin films. The ZnO based ammonia (NH_3) sensors have been fabricated and characterized. The electrical characteristics of the thin films show that the conductivity increases with longer annealing time. The sensor responses towards ammonia gaseous were investigated through homemade NH_3 sensing characteristic measurement system. The NH_3 gas sensing characteristics show that the current responses and sensitivity increase with longer annealing time.

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CHAPTER 1

INTRODUCTION

1.1 AMMONIA

Ammonia is the hydrogen and nitrogen compound with the formula NH_3 and it is form of inorganic compound. It is usually a gas with characteristic of the pungent odour and colourless as a gas [1]. The liquid ammonia posses strong ionizing power at ε of 22. The Ammonia must be store in high pressure or a low temperature place due to the boiling temperature of ammonia is at -33.4°C. Ammonia has trigonal pyramidal shape with bond angel of 107.8° [2].An ammonia is a photon acceptor because it has a lone electron pair. The hydrogen bond makes ammonia highly miscible with water. The hydrogen in ammonia is capable of replacement by metals, hence it could react with metal oxide. Liquid ammonia will dissolve the alkali metal and other electropositive metal such as calcium, zinc, copper and pattosium. The reaction between electropositive metal and ammonia will deliberate electrons, since ammonia is a reducing agent [1]. Figure 1.1 illustrates the ammonia structure.

In the air there are various artificial of ammonia, such as intensive life stock with the decomposition process of manure, fertilizer product and chemical for refrigeration system. Ammonia is found in small quantities in body, atmosphere and rain water [3]. Ammonia contributes a lot of usage in human life, but it is caustic and hazardous to human. In 2006, 146.5 million tons of ammonia was estimates in the commercial used [4]. The ammonia is measured by its concentrations usually in partpermillion or partperbillion.