PREPARATION OF ZINC OXIDE NANORODS ON THIN FILM TEMPLATE USING SOL-GEL METHOD FOR HUMIDITY SENSOR APPLICATIONS

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ABSTRACT

This paper focuses on the preparation of Zinc Oxide (ZnO) nanorods on thin film template for humidity sensor that has been prepared by Sol-gel method. Spin coating process is used to deposit thin film of 5, 10, 15 and 20 layers which act as catalyst followed by immersion process for growth of nanostructured ZnO. The surface morphology is characterized by using Scanning Electron Microscopy (SEM) shows that the 10 layers of thin film give 78.5nm in diameter which is the minimum size ZnO nanorods. Current-voltage measurement indicates that 10 layers of Zno thin film gives high resistance value and the change of resistance over the change of percent relative humidity gives highest sensitivity of 85.013kΩ/%RH to absorb humidity effectively than others because the thicker thin film is easy to peeled-off and affect the sensitivity of ZnO nanorods. It can be concluded that 10 layers of ZnO thin film have high potential as a sensing material for humidity sensor applications.

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CHAPTER 1
INTRODUCTION

1.1 BACKGROUND OF STUDY

Humidity refers to the water vapor content in air or other gases. Recent advances in materials and devices have offered exciting new technologies for the detection of relative humidity which consists of resistance and capacitance elements [1, 2]. The desirable characteristics of humidity sensor are high accuracy and sensitivity, chemical and thermal stability, reproducibility and ability to recover from condensation [5, 8]. The size, packaging and cost effectiveness must be considered in specification.

The applications of humidity sensor include the meteorological services, chemical and food industry, civil engineering, air conditioning, agriculture and electronics processing [5]. ZnO nanostructures such as nanowires, nanorods, nanobelts and nanotetrapod have attracted much attention for humidity sensor applications [4, 5]. ZnO is n-type semiconductor with direct band gap energy of 3.37 eV at room temperature and its properties depend on the crystalinity, crystallographic orientation, crystallite size and morphology [4].

In this study, ZnO has been chosen as the sensing material on percentage of relative humidity (%RH) since it is easily fabricated to form ZnO nanorod on glass substrate-based using sol-gel method [6, 7]. Sol gel process is known to have the distinct advantage of process simplicity and easy control of the film composition [9, 10]. It provides maximum control in doping level, solution concentration, homogeneity and easy to be coated on the desired shape and area [4, 11].

A spin coater is used to deposit different layer of ZnO thin film and it is controlled by the speed, time of spinning as well as volume of resist. They will be kept within ranges for keeping coating thickness in proximity to manufacturing specification [12].