STUDY ON THE ELECTRICAL PROPERTIES OF ZINC OXIDE (ZnO) THIN FILM PREPARED BY SOL-GEL SPIN COATING

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ABSTRACT

This thesis focuses on the effect of annealing temperature to electrical, structural and optical properties of deposited Zinc oxide (ZnO) thin films. ZnO solutions are deposited onto glass and silicon substrates using sol-gel spin coating technique. Deposited films are annealed at various temperatures from 300°C to 500°C. The electrical properties characterized by Current-Voltage (I-V) measurement shows that the resistivity decreased as annealing temperature increased. The structural properties are characterized using Scanning Electron Microscopy (SEM) and X-ray Diffraction (XRD). SEM and XRD analysis indicated denser surface morphology and better crystallinity at higher temperature. The optical properties characterized by UV- spectrophotometer (UV-vis) indicated the transmittance is over 40% in the visible region range from 400 to 800nm and fully absorption at 300nm.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Zinc oxide (ZnO) is a n-type semiconductor with direct band gap energy of 3.37 eV at room temperature and a free-exciton binding energy of 60 meV [4,5]. The property of ZnO is dependent partly on the crystallinity, crystallographic orientation, crystallite size and morphology.

Interest in the research effort on ZnO is driven by various applications in blue and ultraviolet (UV) light emitters [1, 3], solar cell windows [7, 8], photovoltaic device [10], gas sensor [9] and surface acoustic wave device [11]. ZnO is well known for its transparency when made into thin films and is expected to find wide use as transparent electrodes for many devices, such as electrochromic displays (ECDs), electroluminescent displays, and liquid crystal displays (LCDs) and solar cells.

ZnO thin films have been prepared by a variety of techniques, such as R.F. magnetron sputtering [16,17], reactive magnetron sputtering, chemical vapor deposition [18,19], ion-beam evaporation, electron-beam evaporation, spray pyrolysis [20,21], laser ablation and sol-gel process [22,2].

Among the different techniques available, the sol-gel method seems to be the most attractive due to ease of coating on the desired shape and area, easy control of the doping level, solution concentration and homogeneity without using expensive and complicated equipment when compared to other methods.