PHOTORESPONSE CHARACTERISTICS OF ALUMINUM DOPED ZINC OXIDE NANOSTRUCTURE THIN FILMS.

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ABSTRACT

The wide band gap semiconductor of zinc oxide (ZnO) has emerged as a potential material for the fabrication of a range of devices including opto-electronic devices such as light – emitting diodes (LEDs), laser diodes (LDs) and detectors. The goal of this research to achieve the photoresponse characteristic of Al doped ZnO thin films. The thin films of ZnO was doping with different Al concentration using sol-gel method. Dip-coating technique was applied to deposit the glass substrate dip into the ZnO solution. The thin films were dip five times and the preheating temperature at 200°C. All the dipping parameter was fixed and the molar concentration of Al were varies at 1at.%, 3at.%, 5at.%, 7at.% and 9at.%. The thin films were annealed for 1 hour before characterization process. The influence of doping concentration of aluminum on the surface morphologies was characterized by Scanning Electron Microscopy (SEM). The electrical properties of thin films were characterized using 2-probe Current-Voltage (I-V) measurement system (Advantest R6243). The optical properties were studied using UV-Vis-NIR spectrometer. The "as prepared" ZnO nanostructure thin films layers have a grain structure and show a comparably low photocurrent magnitude under dark to illumination. The results show that higher conductivity found under illumination. Al doping concentration proportional increased with electrical conductivity.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Based on this research, Zinc Oxide(ZnO) is used as a main material to study and adding with some factor that effect the ZnO structure and the performance under many parameters. ZnO is a unique material that exhibits semiconducting and piezoelectric dual properties [5]. ZnO has a long history of usage for pigments and protective coatings on metals [5]. The electrical, optoelectronic and photochemical properties of undoped ZnO has resulted in use for solar cells, transparent electrodes and blue/UV light emitting devices [5]. In the past decade, numerous studies have been made on both production and application of one-dimensional ZnO.

Aluminum doped zinc oxide (AZO) coating exhibit high transparency and low resistivity and these materials are suitable for fabricating transparent electrodes in solar cells, gas sensors and ultrasonic oscillators [5]. ZnO is a direct wide-band gap II-VI semiconductor with Eg =3.37 eV and exciton binding energy of ~60 meV at room temperature [1, 2, 4, 5]. Doping of ZnO with various elements has been reported to improve their electrical conductivity for use in optoelectronic device [12]. There are many type of dopants have been used to enhance the conductivities of ZnO. The group III in periodic table (B, Al, In, Ga) is the type of dopants can make a better conductivity to ZnO thin films. From group III, Al-doped ZnO thin films have been widely studied and are considered as candidate materials for organic electroluminescence display [2].