OPTICAL PROPERTIES OF NANOSTRUCTURED ALUMINIUM DOPED ZINC OXIDE THIN FILMS FOR ULTRAVIOLET PHOTOCONDUCTIVE SENSOR APPLICATIONS

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With the name of Allah S.W.T the most Gracious, the most Merciful creator, I seek His Blessing on His Prophet Muhammad s.a.w

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ABSTRACT

Nanostructured Aluminum (Al) doped Zinc Oxide (ZnO) thin films were prepared on glass substrates using immersion technique and the effects of immerse times on the nanostructured ZnO properties were investigated. The processes which involve producing nanostructured ZnO thin films in this research were preparation of Al doped ZnO thin film as seeded catalyst by sol-gel spin-coating method, preparation of nanostructured Al doped ZnO by immersion technique and fabrication of nanostructured Al doped ZnO based ultraviolet (UV) photoconductive sensor. Surface morphology results as characterized by scanning electron microscope (SEM) show that all prepared nanostructured Al doped ZnO were in form of nanorod structures with the typical diameter in the range of 60-250nm and the length within several micrometers. UV-Vis-NIR spectra indicate that the transmittance of the samples decrease with immersion time. Electrical properties study reveals the nanostructured Al doped ZnO thin film at 1 hr shows the highest conductivity compared to other samples. Photocurrent measurement results of the fabricated samples show that UV photoconductive sensor from nanostructured Al doped ZnO thin film immersed at 1 hr gives the highest photocurrent intensity compared with other samples.

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CHAPTER 1

INTRODUCTION

1.1 Background of study

This research focused on to fabricate nanostructured Al doped ZnO thin films using immersion technique for UV photoconductive sensor applications. Firstly, the seeded catalyst was prepared using sol-gel spin-coating method. The purpose of this process was to deposited thin films on the substrate surface. After completed seeded catalyst thin films, the preparation to growth the nanostructured Al doped ZnO thin films was prepared. The process to growth the nanostructured was called immersion technique where it used water bath instrument to immerse the sample for several period of time. After the process completed, all the measurement were made to make sure all the properties were satisfied with the nanostructured Al doped ZnO thin films to fabricate UV photoconductive sensor.

1.2 Problem statement

In recent year, the silicon (Si) material is use as thin films in the semiconductor technology including in UV sensor application. The silicon has several disadvantages. The disadvantages are the UV filter for block the visible light radiation is very expensive, silicon thin films cannot use in high temperature and it cannot resist in the harsh environment. Recently, the study of wide band gap material open the door to fabricate of UV sensor with better performance compare to Si based application. Many wide band materials such as gallium nitrides (GaN), diamond, titanium dioxide (TiO_2) and zinc oxide (ZnO) have been study to fabricate UV sensor. The GaN and diamond have several disadvantages to use as thin films in UV sensor because of diamond and GaN is very expensive material. It also requires expensive equipment for thin films preparation. To overcome this problem, TiO_2 and ZnO have been used as thin films in the UV