

AZO NANORODS GROWTH BY SPUTTERING METHOD

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“The best people are those who are most useful to others”

-Prophet Muhammad-

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ABSTRACT

Aluminum-doped-zinc oxide (AZO) films were grown by RF magnetron sputtering on gold (Au) metal catalyst. The Au catalyst with 5, 10 and 15nm thickness were deposited on ITO substrate by sputter coater method and being annealed for 15 minutes at 500°C. The AZO thin films were then deposited on top of the Au catalyst at different deposition temperatures from 200°C, 300°C, 400°C and 500°C. Apart from deposition temperature, RF power during sputtering were also being varied at 50 W, 100 W and 150 W. The morphology of the AZO films showed different characteristics between those parameters being varied. From the FESEM results, it can be said that, the Au catalyst layer as well as deposition temperature contribute the growth mechanism of the AZO nanostructures. The observed AZO nanostructures were in the form of nanorods distributed un-uniformly on the Au catalyst. The increased of Au catalyst thickness lead to the reducing of AZO nanorods number as well as the nanorods size. Besides that, the AZO nanorods were found to depend directly on the substrate temperatures. The AZO thin films were tested for its sensitivity in pH buffer solutions (pH 4, 7 and 10) for application in extended-gate field effect transistor (EGFET).

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CHAPTER 1

INTRODUCTIONS

1.1 RESEARCH OVERVIEW

This project investigates the effect of varying deposition temperature, radio frequency (RF) power and metal catalyst thickness on the growth of nanorods structure. Until now, much of the discussion on the growing of these nanorods has been focused using wet deposition method which is not compatible with the CMOS technology based manufacturing. So this project will give an overview of the advantages of CMOS process compatible that is sputtering. Mainly, the project was focusing on the structural properties of the deposited thin films. Besides, the electrical property was also being observed and samples were tested to be used as a sensor device.

ZnO already has its own interesting characteristics but attempt has been made in order to bring new interesting properties by doping it with different elements. A group III element, aluminum (Al) was chose as the dopant to increase the electrical conductivity as well as to improve the thermal stability of zinc oxide (ZnO) films[1]. ZnO is an n-type semiconductor because of zinc (Zn) interstitials and oxygen vacancies. As it being heavily doped with Al ions donors, a metal-like property was observed in the resistivity. Hence, this project was using aluminum zinc oxide (AZO) material to deposit the thin films.

The AZO nanostructures were synthesized by using RF sputtering method on different gold (Au) catalyst thickness 5, 10 and 15 nm and also on bare glass respectively. The deposition temperatures were varied from 200, 300, 400 and 500 °C. Other than that, RF powers were also being varied from 50, 100 and 150 W. The investigation was focus