ELECTRICAL PROPERTIES OF ZINC OXIDE (ZnO) NANORODS FOR FET APPLICATIONS

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ABSTRACT

Zinc oxide (ZnO) nanorods have being growth using chemical bath deposition (CBD) method. This is done to investigate the consequences of different annealing temperature and different volume of solutions to the electrical properties of zinc oxide (ZnO) nanorods. The chemical bath deposition (CBD) method is normally used to deposit such as thin films and nanomaterials. There are many advantages using this method such as low cost technique and it is not depending on the expensive equipments. Other than that, it has low process temperature and easy to conduct the process. This study covered three processes which are preparation of Magnesium Zinc Oxide (MgZnO) solution for seed layer deposition by using sol-gel spin coating technique, preparation of Zinc Oxide (ZnO) solutions for ZnO nanorods deposition using chemical bath deposition (CBD) method and for metallization purposed, thermal electron beam evaporator has been employ to deposit alumium as a metal contact. The current-voltage (IV) characteristic has been determined by using IV probe measurement system while optical properties have been analyzed by using Perkin Elmer (LAMBDA 750) UV-VIS Spectrophotometer. The surface morphologies of ZnO nanorods were examined by using FESEM JOEL JSM-7600F while the crystallinity was determined using Rigaku Ultima IV X-Ray Diffraction (XRD). The result depicts that with different annealing temperature, it showed that sample that annealed at 500°C has the highest conductivity (low resistivity) and highest optical transmittance due to the manipulation contact resistance. Meanwhile, with the different volumes of solutions, it depicts that 50ml gave the conductive behaviour compare to the other volumes but for the transparent to visible light, 200ml gave the best result due to highest optical transmittance. As far for the concern, the molarity 0.05M does not change the density.

CONTENT

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

According to the Moore's Law, the number of transistors, most probably field effect transistor (FET) will doubles every two years. As a result, the size become smaller around 250nm to 100nm [1] and can be below than that. Due to this problems, ZnO based material has attracted attention of researchers due to its unique properties and applications including in field effect transistor (FET), transparent electronics, light emitting diodes (LED), solar cells, chemical sensor and piezoelectric devices [2].

ZnO is a semiconductor with direct band gap of 3.37eV and has large excitation binding energy of 60meV at room temperature [3-4] where it gives more efficient emission at room temperature as its unique characteristics. It also made ZnO become transparent to visible light. For instant, ZnO is suitable for photovoltaic applications because it have highest electrical conductivity [3] and optical transmittance.

Zinc oxide (ZnO) can be group to transparent conducting oxide (TCO) where it can be used as transparent electrode in electronic devices. Transparent conducting oxide (TCO) is very important in thin film where ZnO can be most capable materials which are necessary in high transmission and low resistivity [6].

ZnO nanorods have hexagonal wurtzite structure where oxygen atom exist on hexagonal site while zinc atom in tetrahedral site. Under thermal equilibrium,