EFFECT OF SUBSTRATE TEMPERATURE AND CATALYST ANNEALING TREATMENT ON THE OF GROWTH ZINC OXIDE BY TCVD FOR SENSOR APPLICATION

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ABSTRACT

In this project, ZnO thin film were deposited by using Thermal Chemical Vapor Deposition. The growth of ZnO nanostructures was studied on the effect of the substrate temperature and metal catalyst annealing treatment. The substrate temperature was varied between 400°C, 450°C and 500°C. Meanwhile, the process of metal catalyst annealing treatment was varied at 15 min, 30 min and as deposited sample. The field emission scanning electron microscope (FESEM) was used to determine the ZnO morphology and its cross-section. The crytallinity of the sample was examined by using X-ray Diffraction (XRD). Then the thin film were also being tested by using extended gate field effect transistor (EGFET). Lastly, the growth of ZnO nanostructures and sensitivity measurement was clearly observed.

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CHAPTER 1

INTRODUCTION

1.0 BACKGROUND STUDY

In the past decades, nanorods based on different material have been successfully synthesized such as GaN, SnO and ZnO[1]. Among of these materials ZnO is the most exciting contender for fabrication on nanostructures besides of other materials. ZnO is II-IV compound semiconductor material in periodic table[2]. Nanostructured ZnO is the versatile semiconductor because of its attractive physical properties such as direct band gap (Eg = 3.37eV) and large exciton binding energy (60meV) compared to GaN[3,4]. It has stable wurtzite structure with lattice spacing a, b and c is 0.32498 nm, 0.32498 nm and 5.2066 nm respectively[5,6]. ZnO attracted a lot attention due to its unique and special electrical and piezoelectric properties for the application in light emitting diodes[7], solar cell[8] and so on. There are numerous kinds of ZnO nanostructures that have been realized such as nanodots[9], nanowires[10] and so on.

Recently, many ways have been reported to fabricate the ZnO thin films. For instance chemical vapor deposition (CVD), R.F. sputtering and also sol gel method[11]. For this research, thermal chemical vapor deposition was used as technique to deposits ZnO nanostructures. The TCVD method was chosen to deposite ZnO nanostructure because of its high yield and flexibility to design growth recipe[12]. The deposition of ZnO nanostructures using metal catalyst mechanism can provide nucleation site for early stage of ZnO nanostructures growth[13]. Further, the annealing process can restructure the particles of