ELECTRICAL PROPERTIES OF NANOSTRUCTURED ZINC OXIDE THIN FILMS DEPOSITED AT VARIOUS RF POWER BY MAGNETRON SPUTTERING METHOD FOR AMMONIA GAS SENSOR APPLICATION

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ABSTRACT

Nanostructured zinc oxide were deposited on thermally oxidized p-type silicone with various RF power by magnetron sputtering method. The electrical and physical properties of the thin films were investigates. The current-voltage were characterizes using two point probe method and the conductivity of the thin films increases while the resistivity decreases at higher sputtering power. It was found that the zinc oxide deposited at 300W gives the highest sensitivity. The surface morphology of the thin films were characterizes using field effect scanning electron microscope (FE-SEM). The results demonstrate the grain size increases with higher RF power. The thickness of the thin films were measured using DEKTAK 150 Surface Profiler and the result shows that the film thickness were higher as the RF power increase. It was found that the zinc oxide deposited at 300W gives the highest sensitivity.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Nowadays, metal oxide thin films have been used widely in many applications including gas sensing device, fuel cells and solar energy. Zinc oxide has received a considerable attention due to it many advantages such as cheap and abundant raw materials, possible large coating, high stability in hydrogen plasma, electrical conductivity modified by appropriately doped or post-annealing, nontoxic and easy to fabricate. Zinc oxide is a semiconductor materials because zinc belong to the 2^{nd} group and oxygen belongs to the 6^{th} group it the periodic table. Moreover, zinc oxide has a wide direct bandgap (3.37 eV) [1,2], the large exciton binding energy of 60MeV at room temperature [3] and its electrical conductivity is due to intrinsic and extrinsic defects. Others advantage of zinc oxide is chemically sensitive to volatile and other radial gases [4] and high mechanical stability [5]. Zinc oxide crystallizes in three forms, that is Wurtzite, Zinc Blende and Rocksalt. In normal conditions, zinc oxide crystallizes Wurtzite structure [6]. Nanostructured zinc oxide has become an extensive study by many researches because of their novel properties and promising application. A nanostructred zinc oxide can be grown by various physical and chemical techniques to archive different forms such as