CHARACTERIZATION OF ZnO COMPOSITED WITH PEG THIN FILM BY USING SOL-GEL SPIN COATING TECHNIQUE

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ABSTRACT

In this study, ZnO composited with PEG thin film via sol-gel spin coating method has been fabricated. The PEG act as the phase change material (PCM). ITO substrate was chosen because of its electrical conductivity and optical transparency. The main objective for this research was to produce ZnO composited with PEG thin film via sol-gel spin coating method and to explore the physical, structural, optical and electrical characteristics of ZnO/PEG with the different molarity value of ZnO and PEG. There are three parameter that has been studied which were, percentage of PEG that was varied from 10% until 50% with 0.4M of ZnO. Second, the molarity concentration that was varied from 0.1M until 0.4M with the PEG concentration standardized to 10%. Next, parameter layer configuration and annealing temperature that was varied at 300°C and 400°C. All the solution thin film was deposited with the same spin rotation, and drying time and temperature. Physical, optical, structural, and electrical properties of the deposited thin film were analysed using FESEM, XRD, UV-Vis, and I-V measurement. Referring to the result obtained, the morphology structure of the deposited film changes when percentage of PEG increase, where the uniformity can be observed as the percentage increased. Next, from the morphology of concentration of molarity obtained the spread of particles are less on the thin films. Moreover, the morphology of layer configuration and annealing temperature show that the particle size in the thin films tends to increase with annealing temperature. Besides, transmittance and absorbance behaviour also affected by the percentage of the PEG, and concentration of molarity, similar with the XRD spectra and I-V measurement.

Keywords: ZnO, PEG, spin-coating, ITO, FESEM, XRD, UV-Vis, I-V measurement.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Zinc oxide is an inorganic compound with the chemical formula, ZnO. Nowadays, ZnO is widely used as an additive in many applications and materials, ZnO is a white powder that is insoluble in water. ZnO has very wide range of advantages such as high thermal conductivity, good transparency, high electron mobility, and wide bandgap [1].

Moreover, ZnO also chemically and mechanically stable, non-toxic, and high abundant. Thin film ZnO can be prepared by many methods and technique such as atomic layer epitaxy, chemical vapor deposition, spray pyrolysis, sol-gel method and spin coating [2] [3].

Each of the technique has their own advantage and disadvantage but among all of these techniques, sol-gel method is widely used as it is low in cost, simple deposition equipment, able to carry out doping at molecular level, easier adjustment of composition and easy to be fabricated on large-area films [1].

Meanwhile, phase change material (PCM) is a substance with a high heat of fusion which, melting and solidifying at a certain temperature and capable to store and release energy. Heat is absorbed or released when the material changes from solid to liquid and vice versa [4].

Figure 1.1 shows the two processes during heating and cooling of PCM. In each process, PCM undergoes three stages. During heating which is in the first stage in order