THE CHARACTERIZATION OF COPPER OXIDE THIN FILMS USING SOL-GEL METHOD FOR DIFFERENT SPIN COATING SPEEDS

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ABSTRACT

Copper oxide was one of the material promising for solar cell application due to its good optical properties and low thermal emittance. The aim of this research was to study the effects of different spin coating speeds of copper oxide thin films. In this work, quartz substrates were used with 2.0 cm x 2.0 cm dimension and the thickness was 0.1 cm. The substrates cleaning have been performed with standard method where it had been cleaned with acetone, methanol and deionized water in the ultrasonic devices. Copper oxide solution was prepared by sol gel method by mixing the copper acetate with isopropanol, diethanolamine and polyethylene glycol while copper oxide thin films were performed by using spin coating technique. The thin films were deposited at 1000, 1500, 2000, 2500 and 3000 rpm. Five samples of thin films were dried at 250°C for 10 minutes to evaporate the solvent from the solution and annealed at 600°C for 30 minutes as a heat treatment in order to increase the ductility and to provide the sufficient energy for atom arrangement. Then, the samples characterization processes were performed using surface profiler to check the thickness of thin films and atomic field microscope (AFM) to check the surface topology. The absorbance and transmittance of copper oxide thin films were observed using UV-Vis spectrophotometer while the electrical properties were measured using two point probe technique. Prior to the *I-V* measurements characterization, the thin films were coated with platinum as the mental contacts. The thickness of metal contacts deposited onto copper oxide thin films were 0.00006 mm while their width were 3.0 mm. The current values that were obtained from the measurement have been used to calculate the resistivity and conductivity by using the equation given. Based on the results obtained, by comparing all parameters it revealed that the spin coating speed at 1000 rpm that deposited on the copper oxide thin film shows a high electrical conductivity, high transparency and high optical band gap.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND RESEARCH

Copper forms two well known oxide which were CuO and Cu_2O [1]. Cu_2O was also named as cuprous oxide which was a metal deficient semiconductor of p-type conductivity which shows a varying optical behavior because of stoichiometric deviations arising from its preparation techniques and parameters [2-4]. Copper oxide was the first semiconductor material discovered, but was soon overtaken by the fast development of silicon [5]. Copper oxide compounds have been focused on research in fundamental and applied science [6-8]. Several authors have reported that copper oxide had received some attentions for several applications in catalyst, semiconductor, solar cells [9] and electronics [10-12]. The direct optical band gap energy values of copper oxide in range of 2.1 to 2.6 eV [13].

Base on K. Meyer et al [14] in 2013, the physics of cuprous oxide was reviewed with respect to structural, optical, and electrical properties. New experimental findings were included especially in the context of theoretical band structure calculations [14]. Figure 1.1 shows the red spheres represent oxygen and the small pink spheres represent copper. As can be seen in the picture, each copper atom is linearly coordinated by two oxygen atoms.