THE INFLUENCE OF ANNEALING TIME ON COPPER (II) OXIDE THIN FILMS USING SOL-GEL DIP-COATING TECHNIQUE

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ABSTRACT

Copper (II) oxide (CuO) is a promising material for fabrication of photovoltaic devices such as solar cells. The objectives of this project were to deposit CuO thin films on glass substrates using sol-gel dip-coating technique and to characterize the structural, optical and electrical properties of the thin films for various annealing time. The CuO solution was prepared using sol-gel method by dissolving copper (II) acetate powder in isopropanol, diethanolamine and polyethylene glycol. The colour of the solution was dark blue. The molarity of CuO thin films was 0.25M which was deposited by using dip-coating technique on glass substrate. The annealing temperature used was 500°C with different annealing time for each sample of 30 minutes, 60 minutes, 90 minutes, 120 minutes, and 150 minutes. The samples colour were brownish-black after annealed. The surfaces morphology were checked by using Field Emission Scanning Electron Micsroscopy (FESEM). The electrical properties were measured by using two-point probe to check for the thin films resistivity. UV-vis spectrometer was used to check for the transmittance and absorbance of the thin films. Each samples' properties vary as the annealing time increases. As the annealing time increases, the grain size of the thin films increases until sample 90 minutes and started to decrease. For the transmittance percentage, as the annealing time increases, the transmittance percentage increases. The absorbance value for samples decreases as the annealing time increases. The optical band gap increases as the annealing time increases. The optical band gap obtained was in range 2.2 eV until 2.85eV. The current conducted by the samples decreases as the annealing time increases.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This thesis consists of five chapters which covers different aspect of the research. Chapter 1 consists of the introduction of the project including the background of the study, problem statement, objectives, scope of work and significant of work for this research. The project overview were also described. Chapter 2 discusses on the literature review related to the theoretical background of this project. In this chapter, the material used, sol-gel method and dip-coating technique were briefly described. Chapter 3 describes the methodology that illustrates the overall process for this project. This chapter provide the step-by-step procedure for substrates cleaning, sample preparation and the characterization method. Chapter 4 discusses the results obtained for this project. It includes the detail and explanation of the collected data in term of structural, optical and electrical properties of the thin films. Finally, chapter 5 conclude the conclusion of this project which also include the future recommendation.

1.1 RESEARCH BACKGROUND

Nanotechnology is "technology at the nanoscale" or "engineering with atomic precision" which nanoscale is considered to cover the range 1 to 100 nm [1]. Nanotechnology includes the forming and use of materials, structures, devices, and systems that have unique properties because of their small size which also includes the