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EFFECT OF DIFFERENT FLOW RATE ON SnO_2 THIN FILMS USING ELECTROSPRAYING METHOD

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ABSTRACT

In this work, SnO_2 thin films were prepared by electrospraying method and the effect of different flow rate on the physical, electrical and optical properties of the films was studied. SnO_2 solution was prepared by dissolving the ($SnCl_2.2H_2O$) in a 50ml of absolute ethyl alcohol at concentration 1.0M. The solution was deposited on glass substrate at different flow rate; (0.1, 0.2, 0.3, 0.4, 0.5, and 0.6) ml/h. It was annealed at 500°C. Flow rate is one of the parameter that will affect SnO_2 properties. High flow rate will affect surface morphology. In order to obtain particles of nm dimension through electrospray, very low flow rates of the liquid sample are needed. The effects of flow rate parameters on SnO_2 surface morphology were examined using field emission scanning electron microscopy (FESEM) while the optical properties were analysed by UV-Vis spectroscopy. It was noted that the average diameter of these nanoparticles increase from (51-171) nm with increasing the flow rate from (0.1-0.4) ml/h respectively. The optical transmittance showed that nanoparticles have a high transmittance in the visible region with decreasing the flow rate. The I-V characteristic of SnO_2 shows that increasing the flow rates can improve the electrical properties.

Keywords: SnO_2, thin films, electrospraying, flow rate.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Tin (IV) Oxide (SnO_2), one of the semiconductor metal oxide films has drawn many interests. Material likes SnO_2 with wide band gap of 3.6eV has many characteristic which good in optical, chemical, electrical and thermal stability [1][2]. SnO_2 is an important n-type semiconductor material, which shows low electrical resistance and high optical transparency that can be used well in various optoelectronic applications and solar energy conversion [3]. Besides that, SnO_2 has interesting physical and electrical properties that suggest for useful applications such as solid state gas sensor, photovoltaic cells, and infrared reflector [4]. Previous researchers reported that SnO_2 as sensor prepared by electrospraying pyrolysis deposition method showed good sensitivity for H_2 gas without any sensitizer [5][6][7].

The thin films of SnO_2 can be prepared by different deposition techniques, such as sol-gel-dip coatings, spray pyrolysis, electron beam evaporation and sputtering [8][9]. In comparison with other techniques, electrospraying has advantages of simplicity, low cost, process controllability for large scale production applications [10][11]. Another researchers also reported that this technique can cover and suitable for large area applications [12]. Besides, the straight forward experimental arrangement, high growth rate and mass production capability make them also useful for industrial and solar cell application.