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THE EFFECT OF ANNEALING TIME ON TUNGSTEN DOPED VANADIUM DIOXIDE BY USING SOL-GEL SPIN COATING METHOD

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ABSTRACT

In order to overcome global warming, nanotechnologies "Green" need to be addressed urgently. Vanadium dioxide (VO2) is a promising material for energy saving smart windows due to its reversible metal-to-insulator transition near room temperature. Vanadium dioxide is a good and attractive material for application of smart window coating and sensor. Sol gel spin coating method was used because this technique was a good process for preparing the pure VO2 thin films. Tungsten doped vanadium dioxide as precursor successfully effect on their characterization such as electrical and optical properties and surface morphology.. Sol gel spin coating method has unique advantages such as low cost, simple deposition technique, easy adjusting composition as well as dopants and fabricating large area films. Five samples of tungsten doped vanadium dioxide thin films with different annealing time parameter were fabricated on quartz substrates. Isopropanol was used as the precursor that added to the tungsten doped vanadium dioxide. All samples have been characterized for the surface morphology and thickness using field emission scanning electron microscopy (FESEM). While the electrical properties were measured by I-V measurement system and the optical properties were characterized via ultraviolet-visible (UV-Vis) spectrophotometer. A linear graph has been plotted that show the effect of absorbance of the tungsten doped vanadium dioxide. Higher annealing treatment at 5 hours and 550°C were observed that the lower resistivity and higher conductivity which is respectively 0.65Ωm and $1.54(\Omega m)^{-1}$ of tungsten doped vanadium dioxide thin films were improved for smart window application. As conclusion, the objective of this research have be successfully overcome all the problem statement in observed the tungsten doped vanadium dioxide thin films. The effect of different annealing time in tungsten doped vanadium dioxide thin films were successfully characterize the electrical properties, optical properties and surface morphology.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Vanadium dioxide (VO2) is a candidate material because its metal to insulator transition near room temperature is automatic reverse for energy saving smart windows. It is joined by an emotional change in the optical properties in the close infrared area because of their thermally prompted stage progress is reversible from a low temperature straightforward state to an all the more blocking state at high temperatures, by reacting to temperature consequently pervading the VO2 based window with the capacity to direct sun based warmth transition. In this review, the progress in VO2 based saving windows is reviewed, from the band structure planning at the electronic and nuclear scales to morphology designing from nano to miniaturized scale scales [1].

Vanadium dioxide is a great candidate material, which shows the semiconductor metal phase transition (SMT) is automatic reverse [2]. VO2 is a good thermochromic material, which shows the transition of the semiconductor metal phase that can be completely changed at transition temperature (Tt = 67 to 68oC) [3][2][4][5].