ELECTRICAL AND OPTICAL PROPERTIES OF NANOSTRUCTURED TITANIUM DIOXIDE (TiO_2) THIN FILM ANNEALED AT DIFFERENT TEMPERATURES

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ABSTRACT

Nanostructured Titanium Dioxide (TiO_2) thin film has been synthesized using sol-gel method and deposited onto glass substrates using spin coating technique. These thin films then annealed at various temperatures. The electrical, optical and structural characterizations of the as deposited and annealed films were carried out using IV measurement with 4-point probe equipment, UV-Vis spectroscopy, atomic force microscopy (AFM) and scanning electron microscopy (SEM). From this study, it is known that, electrical properties were influenced by changes of annealing temperature. Resistivity of thin films was found to decrease as the annealing temperatures increase. Based on the readings from UV-Vis spectroscopy, it is found that transmittance properties of TiO_2 thin films increased as annealing temperatures increase. This result is supported by surface topography and morphology of the thin films which indicate grains size increasing as temperature increases.

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CHAPTER 1

INTRODUCTION

1.1.Project Background

Many factors limit the efficiency of photovoltaic cells. Silicon is cheap, for example, but in converting light to electricity it wastes most of the energy as heat. The most efficient semiconductors in solar cells are alloys made from elements from group III of the periodic table, like aluminum, gallium, and indium, with elements from group V, like nitrogen and arsenic.

In the race to make solar cells cheaper and more efficient, many researchers are betting on new designs that exploit nanostructured material. Using nanotechnology, researchers can experiment with and control how a material generates, captures, transports, and stores free electrons properties that are important for the conversion of sunlight into electricity.

Two nanotech methods for engineering solar cell materials have shown particular promise. One employs quantum dots--nanosize crystals--that strongly absorb visible light. These tiny semiconductors inject electrons into a metal oxide film, or "sensitize" it, to increase solar energy conversion. Another strategy uses thin films of metal oxide nanoparticles, such as titanium dioxide, doped with other elements, such as nitrogen. Both doping and quantum dot sensitization extend the visible light absorption of the metal oxide materials.

One of semiconductor materials that have been used widely by researchers and physicist is Titanium Dioxide. Titanium dioxide has arisen much attention of chemists and physicists due to the capability of utilization in numerous industrial applications. Among the several oxides of metals, titanium dioxide (TiO_2), a high-k dielectric with excellent biocompatibility and good photocatalytic performance, has been considered to be a