OHMIC CONTACT CHARACTERISTIC OF NANOSTRUCTURED TITANIUM DIOXIDE THIN FILMS ANNEAL AT DIFFERENT TEMPERATURES

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ABSTRACT

This paper studied on the ohmic contact characteristics of nanostructured TiO_2 thin films anneal at different temperature. The preparation of TiO_2 solution used the Titanium (IV) butoxide as a precursor at concentration of 0.2M. TiO_2 thin films were prepared by spin-coating technique and derived sol onto glass substrate, followed by an annealing at temperatures ranging from 350◦C to 550◦C. The result will be analyse on the I-V characteristics and observed it to get the ohmic contact by using gold, platinum and palladium as a metal contact. The influence of the annealing temperature on the electrical, structural and surface morphology of the thin film were characterize by using the I-V measurements, scanning electron microscope (SEM) and atomic force microscope (AFM). Due to the observation in electrical measurement at 550^{o}C, platinum is the best metal contact compared to gold and palladium. This ohmic contact was observed by looking at the capability of metal contact delivering the required current with no voltage drop between the semiconductor and the metal.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Solar cell is the important device in electronic application. It was found as an alternative power source to replace fossil source as a main power source for the future. The photovoltaic effect was first recognized in 1839 by French physicist A. E. Becquerel [1]. However, it was not until 1883 that the first solar cell was built, by Charles Fritts, who coated the semiconductor selenium with an extremely thin layer of gold to form the junctions. The device was only around 1% efficient. Sven Ason Berglund had a number of patents concerning methods of increasing the capacity of these cells. Russell Ohl patented the modern junction semiconductor solar cell in 1946, which was discovered while working on the series of advances that would lead to the transistor.

The silicon solar cell has the monopoly in the photovoltaic market until 1991, where O'Regan and Gratzel [2] introduced a very promising alternative inorganic pn-junction solar cell using the concept of nanoporous semiconductor material. Semiconducting material that had been used is called nanocrystalline Titanium Dioxide (TiO_2) material. TiO_2 films are extensively studied because of their interesting chemical, electrical and optical properties. TiO_2 is a high bandgap semiconductor that is transparent to visible light and has excellent optical transmittance. TiO_2 has high refractive index and good insulating properties, and as a result it is widely used as protective layer for very large scale integrated (VLSI) circuits and for manufacture of optical elements. Additionally TiO_2 films have potential uses for a number of electronic device applications such as dye-sensitized photovoltaic cells as well as antireflective (AR) coatings, gas sensors, electrochromic displays, and planar waveguides. The high dielectric constant of TiO_2 allows its consideration as an alternative to silicon dioxide for ultrathin gate oxide dielectrics used in memory and logic devices.