PREPARATION OF TiO_2 NANOPARTICLE BY DOCTOR BLADE TECHNIQUE

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ABSTRACT

The TiO_2 nanoparticle was prepared by doctor blade technique for dye sensitized solar cells. The TiO_2 powder 99.9 % was mixed into 0.1M. Nitric acid solution (pH 3-4) until completely and added Triton X100 for surfactant. This solution was coated on TCO glass by screen printing method and sintered at 450 °C for 30 minutes obtaining thin film. The thin film was studies physical properties by UV-vis, XRD, SEM and TEM. It was show that, the absorb light in the 200-400 nm range, the structure anatase phase, the structured SEM and TEM size 100-200 nm. The conversion efficiency of light to electricity was 0.126 %, under irradiation of 80 mW/cm^2.

KEYWORDS: dye sensitized solar cells, TiO_2, thin film, TCO glass, doctor blade technique

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INTRODUCTION

Currently, most solar cells made from silicon, which is expensive, the technology is not used in homes everywhere. Because the production of machinery and raw materials are expensive [5]. The limitations of this type of solar cell, the researchers are interested in developing equipment to the energy conversion efficiency of light to electricity is another type of dye-sensitized solar cells (DSSC) by bringing knowledge of nanoparticles applications in conjunction with photoelectrochemical knowledge. Which is believed to low cost [4] made easier to use and less expensive substrate and does not require gas for silicon solar cells. Dye-sensitized solar cell works by the mechanism of electrochemical reactions induced by light. The solar cell is composed of dye sensitized titanium dioxide nanoparticles. Electrolyte solution, the ionization electrode and the second electrode is the electrode's charge.

Therefore, researchers are interested in the preparation of TiO_2 nanoparticle by doctor blade technique for TiO_2 film. for dye-sensitized solar cells next.

MATERIALS AND METHODS

Synthesized TiO_2 nanoparticle by adding 9 ml (in 1 ml increments) of nitric acid (pH 3-4) to six grams of titanium dioxide in a mortar. Grinding for 30 minutes will produce a lump free paste [3-4]. Drop of a surfactant is then added (triton X 100 or dish washing detergent). Suspension is then stored and allow to equilibrate for 15 minutes. After testing to determine which side is conductive, one of the glass slides is then masked off 2 mm on three sides with masking tape. This is to form a mold. A couple of drop if the titanium dioxide suspension is then added and distributed across the area of the mold with a glass rod. The slide is then set aside to dry for one minute. Followed by sintering at 450 °C for 30 min [2, 4]. After cooling down 80 °C. Result of TiO_2 thin flim. Finally.

RESULTS AND DISCUSSION

Figure 1 compares the spectral response of the photocurrent observed with TiO_2 film and TiO_2 sample. Show a absorption edge at around 200-400nm from the ultraviolet region to the visible region. And Figure 2 show the scanning electron micrograph of a typical TiO_2 film deposited by screen printing on a conducting glass [1,4] the result indicated that TiO_2 nanoparticle struture size 100-200 nm. Fig. 3 show Transmission electron microscopy (TEM) image of TiO_2 nanoparticles. Figure 4 and 5 show X-Ray diffraction pattern of nanoparticle TiO_2 film and standard TiO_2, respectively. The resulting that TiO_2 anatese phase after sintering at 450 °C for 30 min. After cooling down 80 °C.

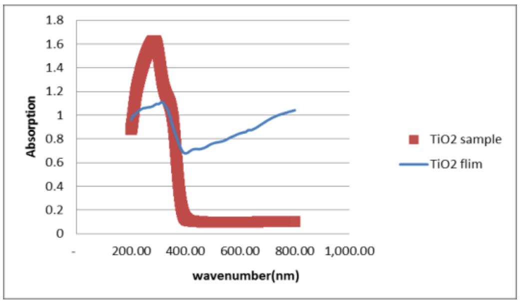

Fig. 1. UV-vis absorption spectra of TiO_2 film comparing TiO_2 sample

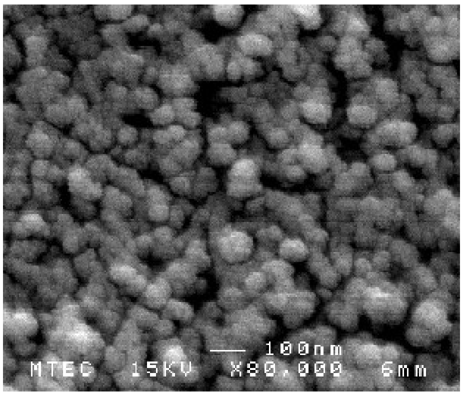

Fig. 2. Scanning electron microscopy (SEM) images of a nanoparticles TiO_2 film

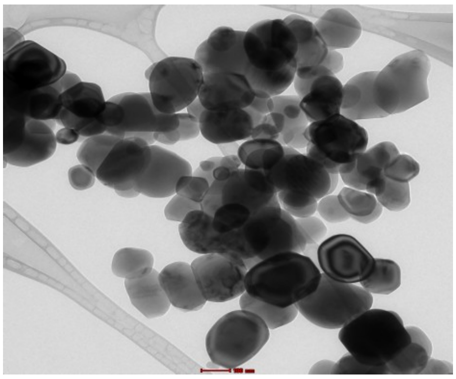

Fig. 3. Transmission electron microscopy (TEM) image of TiO_2 nanoparticles

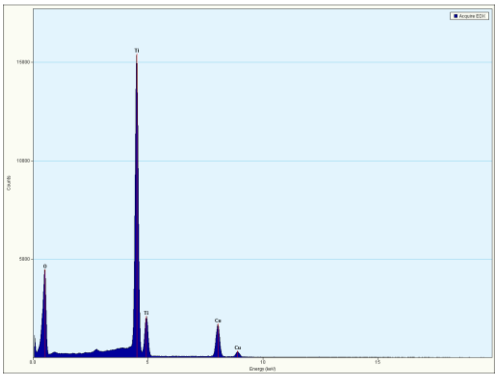

Fig. 4. X-Ray diffraction pattern of nanoparticle TiO_2 film.

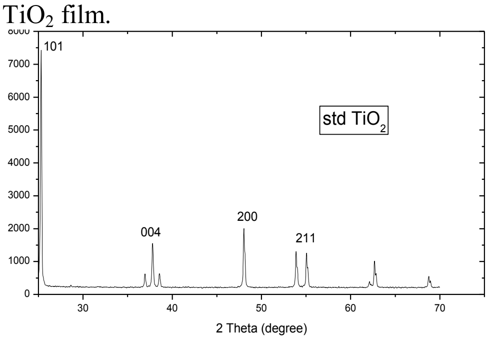

Fig. 5. X-Ray diffraction pattern of standard TiO_2

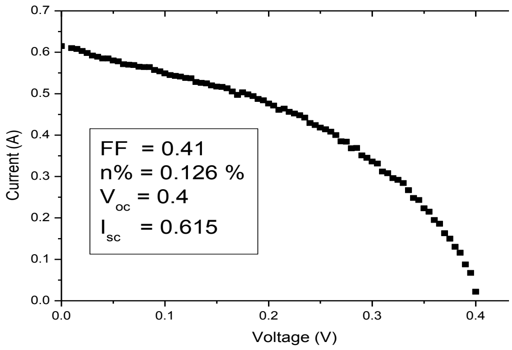

Fig. 6. I-V curves

CONCLUSION

This study investigated physical properties of TiO_2 thin film prepared by screen printing method. XRD identified the phase formation for anatese struture. SEM and TEM images reval that the film nanoparticles strutures size 100-200 nm and UV-vis absorption spectrum result suggested that the absorption peak of the TiO_2 film shifs from the ultraviolet region to the visible region. The energy conversion efficiency of light to electricity were 0.126 %, under irradiation of 80 mW/cm^2.

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