

Research Title	Fabrication of Nano-Powder Spray Coating Machine under Uniform Electric Field with Using the Titanium Dioxide (TiO ₂) Colloidal Solution as the Working Electrode for Dye-sensitized Solar Cell (DSSC)
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ABSTRACT

The research is Fabrication of Nano-Powder Spray Coating Machine under Uniform Electric Field with Using the Titanium Dioxide (TiO₂) Colloidal Solution as the Working Electrode for Dye-sensitized Solar Cell (DSSC). The spray coating machine TiO₂ scattering layer consists of acyclic box which width, length and high of 2.5, 30 and 25 cm, respectively, flow rate control system of O₂ gas, nozzle gun and substrate holder that rotation control with DC power supply. The TiO₂ colloidal solution was prepared by magnetic stirrer at concentration of 0.75%. The TiO₂ scattering layer was injected by spray coating machine under O₂ gas. The condition of TiO₂ scattering layer was varied with pulse spray at 5, 10, 15 and 20 times under substrate holder rotation on the TiO₂ working electrode substrate. Then, the TiO₂ working electrodes were sintered at 500°C for 1 hr. Then, the TiO₂ working electrodes were immersed in dye sensitizer. After that, the TiO₂ mixed dye sensitizer working electrodes were analyzed by scanning electron microscopy (SEM), X-ray diffraction (XRD) and UV-vis spectrophotometer as study to morphological, structural and optical properties, respectively. The DSSC cells were fabricated by the TiO₂ mixed dye sensitizer working electrodes sandwich with the Pt counter electrode. DSSC cells were compared with the TiO₂ scattering layer, non-TiO₂ scattering layer and standard cells. DSSC cells were measured by solar simulator (AM 1.5).

Results found that, we can be creating spray coating machine for TiO_2 scattering layer successfully. The structure characteristic of TiO_2 scattering layer on TiO_2 mixed dye sensitizer working electrode/FTO substrates exhibits crystalline of anatase phase TiO_2 plane (101) and found rutile phase of standard cell. Surface morphology characteristic of TiO_2 scattering layer on TiO_2 mixed dye sensitizer working electrode/FTO substrates shows uniform distribution since 15 times over. It can see nano-micro TiO_2 particles and thickness of TiO_2 scattering layer and TiO_2 mixed dye sensitizer working electrodes have approximately of 1 – 1.5 μm and 10 – 20 μm , respectively. Transmittances spectra of TiO_2 scattering layer on TiO_2 mixed dye sensitizer working electrode/FTO substrates have lower 50%. Reflections spectra have lower 50% and absorbance can be absorbed of 1 – 2% show that low transmittance, low reflection and low absorption in visible light which occur light scattering effect in TiO_2 scattering layer well. The efficiency of DSSC cells can be highest obtains which consists of the open circuit voltage (V_{oc}), the current density (J_{sc}), Fill Factor (FF) and efficiency of 0.77 V, 14.57 mA/cm^2 , 0.65 and 7.33%, respectively for the condition of TiO_2 scattering layer pulsed spray of 10 times. Thus, TiO_2 scattering layer supports to increases light scattering in cell and photon energy absorption lead to efficiency increases so that TiO_2 scattering layer suitable for development of DSSC.