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Optimization of TiO_2 thin film thickness for dye sensitized solar cell applications (Conference Paper) (Open Access)

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Abstract

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Dye sensitized solar cells (DSSCs) rely on the absorption of photons by the dye molecules which are transported to the conduction band of the TiO_2 electrode. The microstructure, energy gap and the absorption spectra of the TiO_2 electrodes highly affects the efficiency of the cell . In this paper, the absorption spectra and energy gap has been studied by varying the thickness of the TiO_2 paste. Nanocrystalline TiO_2 thin films were deposited on ITO glass substrate with three different thickness (4.54μm, 7.12μm and 12.3μm) by using doctor blade method. After deposition all the samples were sintered at 450°C after deposition to enhance the particle bonding and for achieving better adhesion. The samples were characterized by UV-VIS spectra for determining the absorption spectra and Scanning Electron Microscopy (SEM) for investigating the thickness and the surface morphology. Fabricating the electrodes with different thickness showed significant changes in the energy gap and from the results it can be concluded that the energy gap increases with the increased thickness . The highest energy gap of 2.25ev and absorption 3.791 was achieved by 12.3μm thick sample. The absorption spectra also shows better absorption throughout the whole visible light range but the SEM images suggests that 12.3μm thick sample shows cracks all over the deposited region which will cause current leakage when the cell is assembled. Therefore, the optimum result was achieved by 7.12μm thick sample providing 1.9 ev energy gap and 3.91 absorption peak.

Indexed keywords

Engineering controlled terms: Absorption spectra, Deposition, Electrodes, Electromagnetic wave absorption, Energy gap, Film thickness, ITO glass, Light, Manufacture, Nanocrystals, Nanostructured materials, Scanning electron microscopy, Solar cells, Substrates, Thin films, Titanium dioxide

Engineering uncontrolled terms: Absorption peaks, Current leakage, Different thickness, Doctor blade method, Glass substrates, Nanocrystalline TiO2, Particle bondings, TiO2 thin films

Engineering main heading: Dye - sensitized solar cells

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