PREPARATION AND CHARACTERIZATION OF NANOCOMPOSITE NITROGEN-DOPED TiO_2/CdS FOR DYE-SENSITZED SOLAR CELLS

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The nanocomposite N-TiO_2/CdS nanocomposite have been synthesize through direct formation of nanosize CdS on the nitrogen-doped TiO_2 film. Its surface modified of N-TiO_2 film was then applied in dye-sensitized solar cells with and without the use of dye sensitizer. The component of the nanocomposite was studied by X-Ray diffraction (XRD) and X-ray Photoelectron Spectroscopy (XPS), while the structure of the film was characterized with gas sorption analyzer and scanning electron microscopy (SEM). The charge separation and diffusion processes inside modified and unmodified N-TiO_2 film were analyzed using diffuse photovoltage sepectroscopy. The result showed that the CdS particles were 4-7 nm and discrete on the surface of N-TiO_2 film. The diffusion signals revealed that the traps on N-TiO_2 surface were extremely reduced in the presence of CdS. The use of dye sensitizer was resulting a higher overall solar cell efficiency (8.7%) compared to only CdS sensitized N-TiO_2 (6.9%). It was also observed significant enhanced photoresponse in the solar cells based on this nanocomposite compared to the solar cells based on unmodified N-TiO_2 or CdS/TiO_2. The enhancement is related to the synergistic effect of CdS sensitization and N-doping that facilitate hole transfer/transport from CdS to N-TiO_2 through oxygen vacancy states mediated by N-doping. The result also demonstrated that designing and manipulating the band energy in composite nanomaterial is a fundamental factor to improve the charge separation and transport in solar cells system.

Keywords : nanocomposite, dye-sensitized solar cells, N-doped TiO_2