

The Effect of the Film Structure on Electron Transport in Dye-Sensitized Titanium Dioxide Solar Cells

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Over the past decade, there has been widespread interest in understanding the transport of electrons in dye-sensitized solar cells based on nanostructured TiO₂ films. Current theories of transport are based on electrons interacting with an exponential distribution of traps adjacent to the TiO₂ conduction band. However, the role of the structure of the TiO₂ films on the electron transport dynamics has not been explored. We are currently investigating this issue. The porosity of the TiO₂ films has been systematically varied between 52 % and 71 %. Using dye-sensitized solar cells based on these films, the electron diffusion coefficients are determined by transient photocurrent spectroscopy. Titanium dioxide nanoparticle films are also constructed by computer modeling, and electron transport is investigated by random-walk simulations. The experimental results and simulation results are compared to determine whether the film structure plays a role in electron transport through the films.