

Investigation of the Effect of Structural Parameters on the Improvement of the Conversion Efficiency in Nanostructured Solar cells

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Due to their low cost and ease of production, Dye Sensitized Solar Cells (DSSCs) as one kind of third generation solar cells, promise to achieve a clean and endless source of energy for the future. In DSSCs, the recombination of electrons with acceptor species in the electrolyte cause electrons to have a finite diffusion length and low efficiency. Therefore, they are not ideally suited for harvesting a large amount of the suns radiation.

However, by using Quasi-one-dimensional and Quasi-two-dimensional nanostructures as active layers in such cells, both, the transport parameters and the efficiency can be improved: The structures cause an increase in the diffusion length by creating special transport channels in the TiO_2 paste, which positively effects the DSSC efficiency. Today, research on structures which eases the transport more than common porous layers is progressing rapidly. In this context, we propose to use quasi-one-dimensional structures of TiO_2 nanoparticles with various size and dimensions. The efficiency and microscopic parameters with relevance to the electron transport was investigated. The results have shown that the electron diffusion coefficient, at low Fermi levels, considerably enhanced in the solar cells which are made of TiO_2 nanoparticles columns, compared to the cells which contained an interconnected network of TiO_2 nanoparticles in lower electron density conditions. Our experimental results about the changes of the diffusion coefficient with the area of microstructures, match well with theoretical predictions.