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One-step synthesis of titanate microstructures as efficient light scattering layer for dye-sensitized solar cells

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Non-renewable energy sources such as fossil fuels are still the first choice in energy resources. However, in order to maintain energy security and avoid the environmental problems caused by these energies, such as the greenhouse effect and air pollution, the focus should be shifted to renewable energy sources. These renewable energies have many advantages, such as harmlessness to the environment, abundant sources, and the ability to renew them because they are unlimited ([1], [2]). Dye sensitized solar cells (DSCs), a third generation photovoltaic technology, are one of the most promising photovoltaic technologies for generating renewable, clean, and affordable energy. They are generally made from cheap and non-toxic components ([3]). As a crucial component of DSSC, the photoanode must perform several functions, such as a large BET surface area for dye adsorption, a suitable band gap for electron transport, and a suitable size for light scattering effect ([4]). Researchers have claimed that the energy conversion efficiency (PCE) is closely related to the intrinsic properties of the photoanode materials, as the photoanode plays a key role in DSSCs([5]). Herein, we report a simple, environmentally friendly hydrothermal process for large-scale fabrication of sodium titanate architectures in a NaOH solution medium to be used as a light scattering layer (LSL) in DSSCs. we use titanate as an oxide semiconductor in DSSCs due to its excellent optical and electronic properties (as a wide bandgap semiconductor) as well as its long-term stability, low cost, and nontoxicity. Titanate is used as LSL in the photoanode because LSL is important to prevent or reduce light loss during the DSSC process, which can lead to a decrease in power conversion efficiency (PCE). The more light captured on the sensitized photoanode, the more dye molecules are excited and the more voltage and current are generated, leading to an increase in the PCE of the DSSC device. Thus, the addition of LSL leads to a decrease in the recombination effect and an increase in the light scattering effect to improve the DSSC performance

Keywords: renewable energy, solar cell, DSSCs, light scattering layer, titanate.

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