

Dye Sensitized Solar Cell Based on Highly Ordered TiO₂ Nanorods Photoelectrode

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The highly ordered tetragonal TiO₂ NRs were synthesized on FTO substrates with ethanol/DI water (80:20 v/v) as the precursor solution by a single step hydrothermal synthesis at 150°C. With ethanol/DI water (80:20 v/v) as solvent, the highly ordered tetragonal TiO₂ NRs were obtained on FTO substrates with the average lengths of ~2-4 μm and diameters ~50-70 nm respectively while, the round headed and distorted hexagonal TiO₂ NRs were formed with ethanol/DI water ratios of 50:50 v/v and 0:100 v/v as the precursor solutions respectively. XPS studies evidenced that the grown TiO₂ NRs exhibited the O:Ti stoichiometric ratio of 2:1 with lower impurities of carbon species. A solar-to-electricity conversion efficiency of ~3.2% was achieved by DSSC, fabricated with highly ordered tetragonal TiO₂ NRs photoanode, whereas DSSC with the distorted hexagonal TiO₂ NRs photoanode showed inferior overall conversion efficiency (~1.08%). The improved photovoltaic performance was credited to the highly ordered morphology of the TiO₂ NRs, which executed the high charge collection and the transfer of electrons at the interfaces of the TiO₂ NRs photoanode and the electrolyte layer.