Essential role of N and Au on TiO2 as photoanode for efficient dye-sensitized solar cells

ABSTRACT

We firstly report on the successful application of a gold nanoparticles deposited nitrogen doped-titania (Au/N-TiO2) nanocomposite as an efficient photoanode for highly efficient dye-sensitized solar cells (DSSC) with the standard photosensitizer, N719 dye. The Au/N-TiO2 nanocomposites with different Au contents are prepared using a simple chemical reduction method and characterized using various analytical techniques. The DSSC assembled with the Au/N-TiO2 modified photoanode demonstrated an enhanced solar-to-electrical energy conversion efficiency of 7.90% compared to the photoanode of a DSSC composed of bare TiO2 (2.55%) under full sunlight illumination (100 mW cmī 2, AM 1.5G). This enhanced efficiency is mainly attributed to the doping of N and deposition of Au NPs on the TiO2 surface as a resultant of reduction in the band-gap energy, plasmonic effect improved interfacial charge transfer process and minimized charge recombination. The influence of Au content on the overall energy conversion efficiency is also investigated, and the optimum Au content for N-TiO2 is found to be 10 mM. The enhanced solar energy conversion efficiency demonstrated by the Au/N-TiO2 nanocomposite makes it a promising alternative to conventional photoanode-based DSSCs.

Keyword: N-doped TiO2-Au; Nanocomposite; Plasmonic photoanode; Dye-sensitized solar cells