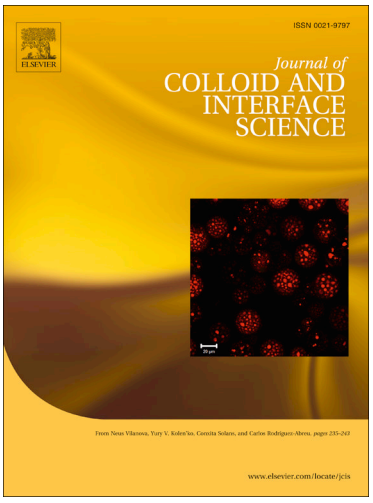

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Controlled charge-dynamics in cobalt-doped TiO_2 nanowire photoanodes for enhanced photoelectrochemical water splitting

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ABSTRACT

In this study, we report for the first time the controlled Co-doping in TiO_2 nanowire (NW) arrays grown on the FTO substrate for highly efficient photoelectrochemical (PEC) water splitting. The Co/TiO_2 and pristine TiO_2 are single crystalline with a tetragonal rutile structure, while the primary peaks were transformed to (002) with the adding of Co. Compared to pristine TiO_2 NW photoanode, the photocurrent of as-prepared Co/TiO_2 NW arrays electrodes show a higher PEC activity with up to ~150% of photocurrent density increase under simulated solar radiation. The Co-doping enabled to control the charge dynamics in TiO_2 photoanode and thus can achieve an enhanced photocurrent density. The electrochemical impedance measurement indicates that the density of photogenerated carriers can be significantly increased by the Co doping. The Co/TiO_2 NW photoanodes exhibit high stability in photoelectrochemical conversion and show great potential for a variety of solar energy driven applications.

Keywords

TiO_2; Nanowires; Hydrothermal; Co-doping; Photoelectrochemical water splitting

1. Introduction

Hydrogen evolution from solar-driven water splitting provides an environmentally and sustainable strategy to face the global energy crisis, since the solar energy is one of the inexhaustible energy sources and hydrogen is storable, transportable and high capacity density. Well-known, one-dimensional (1D) nanostructured semiconductor photoanodes have been