Green Synthesis of Au and Au@TiO_2 core-shell structure formation by hydrothermal method for Dye Sensitized Solar Cell Applications

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Abstract

We report the synthesis of Au nanoparticles and Au@TiO_2 core-shell nanostructures using a facile green synthesis route and hydrothermal method respectively. Au@TiO_2 core-shell particles were used instead of bare TiO_2 photo-anode in conventional dye sensitized solar cells (DSSC) and the cell performance was evaluated. The core-shell structures were characterized for structural and optical properties. The average particle size, stability and polydispersity of the colloidal AuNPs were measured by dynamic light scattering method. Dye sensitized solar cells (DSSCs) were fabricated using pure TiO_2 and Au@TiO_2 as photoanodes with N719 dye. The short circuit current density of Au@TiO_2-DSSC was found to increase by 40% when compared to that of the pureTiO_2-DSSC. The electrochemical impedance spectroscopic measurement reveals that Au@TiO_2-DSSC is having reduced charge transfer resistance and with increased lifetime of the electron. Incident photon to current conversion efficiency (IPCE) studies also reveals that the Au@TiO_2-DSSC exhibits better performance when compared to that of the pure TiO_2-DSSC due to direct coupling between surface plasmon resonance effect of gold nanoparticles and N719 dye molecules.

Keywords: green synthesis; core-shell; Au@TiO_2-DSSC; TEM