Plasmonic enhanced Au decorated TiO2 nanotube arrays as a visible light active catalyst towards photocatalytic CO2 conversion to CH4

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ABSTRACT

To boost up the plasmonic metal-nanotube junction effect under visible light irradiation, a simplistic electrochemical deposition synthesis method has been employed to decorate the Au nanoparticles in the nanotubes (TNTs). A photocatalytic experiment for the conversion of CO_2 has been conducted to justify the visible light effectivity of the Au-TNTs. The decoration of Au nanoparticles into the TNTs was explored by the morphological analysis which revealed well-arranged, well-ordered and stable Au modified nanotubes. The prepared Au-TNTs light harvesting properties investigated through UV–vis absorption spectra which reveals its visible light absorption capability owing to its LSPR behaviour. Improved charge carrier separation of plasmonic Au loaded TNTs was explored through PL analysis. Hence, the photocatalytic activity of TNTs and Au-TNTs obtained through CO_2conversion to CH_4 and the total amount of CH_4 production are 8.26% and 14.67%, respectively. Therefore, this study provides a simple path to modify the TNTs with Au with a trouble-free and controllable deposition method in order to increase visible light active catalytic properties. Moreover, the one-dimensional nanotube arrays semiconductor with the integration of plasmonic metal was attained a further visible light enhanced activity towards photocatalytic CO_2 conversion.

KEYWORDS
Plasmonic metal; Au-TNTs; LSPR; One-dimensional nanotube; Visible light; CO_2 conversion

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