Photo-assisted Boosting of Formic Acid Electrooxidation on TiO_2 Nanotube-Pt Electrode

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Abstract

Using solvothermal method, TiO_2 nanotubes coupled with Pt composite was synthesized successfully as the working electrode to be tested in the photoelectrooxidation of formic acid for applications such as fuel cells. Surface characterization as well as electrochemical characterization of the electrode has been studied under the effect of light in order to determine the current generation of the photoactive electrode. Firstly, results show that Pt coupled with TiO_2 lead to synergistic, i.e. boosting effect in the increase of current density. Secondly, in the presence of light there is about 10 fold increase in current density (63.1 $mA*cm^{-2}$) as compared to the absence of light (6.5 $mA*cm^{-2}$). In addition, we show the affect in current generation as a result of voltage bias effect, thus leads to the observation that the longer the working electrode encounters light, the greater number of electrons that is generated to yield a higher current density. The study of this process indicates a progressive current generation from light off to light on, traversing the whole range of the current generation.