Photoelectrocatalytic reduction of CO2 to methanol over CuFe2O4@PANI photocathode

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ABSTRACT

The present study was aimed to convert CO2 into methanol which not only addresses the potential solution for controlling the CO2 concentration level in the atmosphere but also offers an alternative approach for the production of renewable energy source. In this perspective, a hybrid photocatalyst, PANI@CuFe2O4 was synthesized, characterized and used as a photocathode for photoelectrocatalytic (PEC) reduction of CO2 to methanol in aqueous medium at an applied potential of −0.4 V vs NHE under visible light irradiation. The combination of PANI with CuFe2O4 greatly increased the PEC CO2 reduction to methanol owing to enhance the CO2 chemisorption capacity by the photocathode surface and at the same time facilitated the separation of photogenerated electron-hole (e−/h+) pairs. The incident photon to current efficiency (IPCE) and quantum efficiency (QE) for methanol formation in PEC CO2 reduction could be achieved as 7.1 and 24.0% respectively. The rate of formation of methanol in PEC CO2 reduction was found as 49.3 μmol g−1h−1 with 73% Faradaic efficiency. Compared to photocatalytic reaction, the PEC results demonstrated that the applied potential could effectively separate the photogenerated e−/h+ pairs and therefore, enhanced the PEC CO2 reduction activity of the hybrid photocatalyst.

KEYWORDS

Photocathode; PEC CO2 reduction; PANI@CuFe2O4; Electron-hole separation; Efficiency

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