Photoelectrochemical reduction of carbon dioxide to methanol on p-type $CuFe_2O_4$ under visible light irradiation

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ABSTRACT

Artificial photosynthesis has the potential to produce solar fuels from CO_2 and H_2O using an efficient photocatalyst. Semiconductor with low band gap and high stability is always the right candidate to be used as photocatalyst. Photocatalytic (PC) reduction of CO_2 suffers from slow reaction kinetics and poor yield of product. Photocatalytic reaction in assistance with judicious bias potential is a solution to increase the catalytic activity and reduce the electron/hole (e^-/h^+) recombination rate. In the present work, a *p*-type $CuFe_2O_4$ was synthesized and used for photoelectrochemical (PEC) CO_2 reduction. The catalyst was characterized by UV-visible spectroscopy (UV-vis), Mott-Schottky (MS), chronoamperometry, X-Ray powder diffraction (XRD), X-Ray photoelectron spectroscopy (XPS) and transmission electron microscopy (TEM). Methanol was found as only product in liquid phase produced by photoelectrochemical reduction of CO_2 at a bias potential of −0.5 V (vs NHE) under light irradiation (at 470 nm). The quantum efficiency and incident photon to current efficiency(IPCE) were found as 14.4% and 5.1% respectively revealed that, $CuFe_2O_4$ is a potential photocathode for PEC of CO_2 reduction.

KEYWORDS:

CuFe2O4; CO2 reduction; Photoelectrochemical reduction; IPCE; Quantum efficiency