Photoelectrochemical Reduction of CO₂ to Alcohols at CuO/CuFeO₂ Thin Film Electrode

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CuFeO₂/CuO thin film electrodes are fabricated by electrodeposition method in dimethyl sulfoxide. With the increase of deposition potential and annealing temperature, the peak intensity of both CuO(111) and CuFeO₂(101) becomes stronger. The resulted thin film electrodes exhibit high absorbance in visible light range. The photoelectrocatalytic performance of CuFeO₂/CuO thin film electrodes for CO₂ reduction is examined. At the applied potential between -0.50 to -0.80 V (vs. saturated calomel electrode), CO₂ can be reduced to methanol and ethanol. The highest concentration of ethanol occurs at the applied potential of -0.63 V, whereas that of methanol occurs at -0.70 V. There is a strong relationship between Cu/Fe molar ratio on the thin film electrode surface and ethanol concentration, and ethanol concentration increases with the decrease of the Cu/Fe molar ratio of the thin film surface.

Keywords: CuO/CuFeO₂ thin film electrode, photoelectrochemical reduction, carbon dioxide, methanol, ethanol.

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