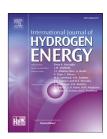


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Titanium dioxide-coated copper electrodes for hydrogen production by water splitting



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HIGHLIGHTS

- Development of TiO₂-C/Cu electrode for hydrogen production by UV irradiation.
- Cu corrosion was prohibited due to TiO2 layer.
- Enhancement of hydrogen production by TiO₂–C/Cu electrode.
- Decomposition of formaldehyde in artificial wastewater by TiO₂-C/Cu electrode.

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ABSTRACT

Pt is the most commonly used electrode and catalyst materials for H_2 production via water splitting as it provides the highest Gibbs free energy of H_2 adsorption (ΔG_H) an d overpotential. However, as Pt catalysts are expensive and difficult to mass-produce, several efforts have been made to identify suitable substitutes. Although Cu provides lower ΔG_H and overpotential than Pt, it exhibits better catalytic performance than other catalysts and is suitable for H2 production. However, corrosion of Cu may affect its stability of Cu electrode. To overcome this limitation, we have coated a layer of carbon on the copper electrode and then synthesized titanium dioxide-(TiO₂-) on the C/Cu electrode for water splitting application. Carbon black (CB) has excellent electrical conductivity and stable resistance for effective working as an electrochemical catalyst, and TiO2 has diverse applications because of its low-cost, non-toxic, and corrosion-resistant characteristics. In this study, TiO2 was synthesized on C/Cu electrodes under UV irradiation for different durations. The optimum irradiation duration was determined to be 15 min via surface and electrochemical analyses. To identify the potential applications of this TiO2 -C/Cu electrode, we used artificial wastewater as the electrolyte. The synthesized TiO₂ -C/Cu electrode exhibited better stability than C/Cu electrode. Further, H_2 production with TiO_2 —C/Cu electrode was higher than that with C/Cu electrode at the same current density. We also investigated the effect of TiO2-C/Cu electrode on decomposition of formaldehyde.

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