New Approach to Increase Hydrogen Production by Adding Magnetic Field to the Photoelectrochemical Water Splitting of Metal Oxides Thin Films

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Green hydrogen is a global need for its emergence as a sustainable, clean, and renewable source of energy. Photoelectrochemical water splitting is one technique for producing green hydrogen. However, Numerous critical factors, both internal and external affecting Photoelectrochemical water splitting performance. The purpose of this research is adding external magnetic field as a new approach that improves photoelectrochemical water splitting performance, thus increasing hydrogen production. In order to study the effects of magnetic fields on metal oxide thin films in both cathode and anode electrodes, comparisons between two conditions have been made, in the presence and the absence of magnets. The photocatalysts have been fabricated using AACVD to deposit CuO-Cu2O, Fe2O3 and CuO-Cu2O/ Fe2O3 on FTO glass. Then, the films were coupled with multiple pieces of magnet. The magnetic field assisted to accelerate charge transfer, decrease charge carrier recombination and reduce gas bubble adhesion on the surface electrode which led to increase the photocurrent and hydrogen production. The results showed significant hike of 300% hydrogen production when the anode electrode increased the photocurrent by adding magnetic field. And in the cathode electrode, the photocurrent and hydrogen production increased 165% respectively with the presence of magnetic field. It was found after analyzing the photoluminescence spectra that the excitation intensity increased when samples were coupled with magnets. More hydrogen will be produced by enhancing photoelectrochemical water splitting with magnetic field, which will be used as renewable energy source for transportations to decrease the high consumption of fossil fuels.

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