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Development of Cu₂O thin films under the influence of electrochemical impedance: Applications in improved photoelectrochemical water reduction

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Abstract

An impedance assisted novel electrochemical technique has been employed to develop copper oxide (Cu₂O) thin films on F-doped tin oxide (FTO)-coated glass substrate. Application of various potentials (-0.60 to -0.40 vs (Ag/AgCl)/V) in the presence of different ranges of frequency can lead to the attainment of high-quality Cu₂O crystallites. The dependency of the frequency boundary (i.e. in terms of deposition time) with structural, morphological, optical and photoelectrochemical (PEC) behavior of the Cu₂O thin films have been studied. The PEC performance of the optimized Cu₂O electrode significantly enhances the water reduction photocurrent to -2.9 mA cm⁻². The Cu₂O thin film developed in this study exhibits superior photoelectrochemical performance in comparison with the conventionally electrodeposited materials.