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Enhancing the photocurrent response of morphology tailored Cu2O nanostructures for photoelectrochemical water-splitting

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Cuprous Oxide (Cu2O) nanostructures are known for their wide range of applications in photovoltaic devices, photoelectrochemical (PEC) cells, gas sensing devices and catalysts. They possess unique properties which are beneficial for PEC applications such as tunable narrow bandgaps and suitable band-edge positions. Furthermore, they are abundant and non-toxic in nature. Cu2O nanostructures such as nanospheres, nanocubes, nanorods, nanoflowers and nanowires have been previously achieved for effective PEC applications, respectively. In this study, we have fabricated Cu2O thin films prepared on fluorine-doped tin oxide (FTO) substrates. The morphology of the thin films was altered through the synthesis of various Cu2O shapes (nanotubes, nanosheets and nanodisks), particle sizes and annealing temperatures. The highly crystalline Cu2O nanostructures were confirmed by RAMAN spectroscopy. The surface morphology, chemical composition, and crystal structures of the prepared Cu2O thin films were investigated using the Field Emission Scanning Electron Microscope (FE-SEM) and Transmission Electron Microscope (TEM). The roughness of the surface was studied using an Atomic Force Microscopy (AFM). Ultraviolet–visible spectroscopy (UV-Vis) was used to study the photoabsorbance of the films. Lastly the thin films were used as photoelectrodes in a three-electrode electrochemical system to study their PEC properties. The enhanced photocurrent response of the films is attributed to the altered morphology, strong photoabsorbance, crystallization and low resistance of the transfer of charge carriers at the solid/liquid interface of the films. This study gave emphasis on the role of changing the morphology of Cu2O nanostructures to improve the process of water reduction on the photocathode/electrolyte interface.

Apply to be considered for a student ; award (Yes / No)?

Yes

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