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Electrosprayed copper hexaoxodivanadate (CuV_2O_6) and pyrovanadate ($\text{Cu}_2\text{V}_2\text{O}_7$) photoanodes for efficient solar water splitting

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Abstract

Copper hexaoxodivanadate (CuV_2O_6) and copper pyrovanadate ($\text{Cu}_2\text{V}_2\text{O}_7$) films were fabricated via electrostatic spray deposition for use as photoanodes for solar water splitting. The fabricated films were characterized by scanning electron microscopy, X-ray photoelectron spectroscopy, Raman spectroscopy, Transmission electron microscopy and X-ray diffraction analysis. The highest photocurrent density observed was $0.65 \text{ mA}\cdot\text{cm}^{-2}$ for a spraying time of 5 min in a mixed aqueous electrolyte consisting of 0.1 M borate and 0.1 M Na_2SO_3 . The high photocurrent density is attributable to an improvement in the electrochemical kinetics at the electrode surface because of the scavenging holes from the electrolyte. The optimal annealing temperature was determined to be 500°C . Further, $\text{Cu}_2\text{V}_2\text{O}_7$ was confirmed to be more suitable than CuV_2O_6 with respect to water splitting, as it exhibited a higher photocurrent density.

Keywords: Copper vanadate oxide, Water splitting, Photocurrent, Photoanode

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