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Paper: Diversity

Water splitting by electrodeposited cuprous oxide photoelectrodes with a flower-like morphology

Morphology of semiconductor films plays a major role in determining the efficiency of solar cell devices. Intrinsic electronic properties of cuprous oxide (Cu_2O) are important for water splitting reaction using solar energy to produce environmentally clean hydrogen fuel. Especially, the n-type cuprous oxide thin films with flower-like morphology have an added advantage for efficient water splitting.

In this study electrodeposition of Cu_2O thin films using an aqueous H_2O_2 bath was investigated for the possibility of depositing films on Ti substrates with a flower-like morphology. Direct deposition of Cu_2O films on a Ti substrate using a H_2O_2 bath is not possible. However, it was found that if a thin Cu_2O film was deposited using an acetate bath prior to the film deposition, good films with a flower-like morphology can be electrodeposited.

In this study, Cu2O thin films were deposited on Ti substrates in a bath containing 0.1M $CuSO_4$ and 0.3M H_2O_2 at 60^0C. pH value of the bath was kept at 4 by adding few drops of dilute NaOH solution. SEM pictures show the flower–like morphology of the films. V-I characteristics and the spectral responses confirmed the n-type behavior of the deposited films. Possibility of water splitting using n-type Cu_2O films without applying an external bias is demonstrated in this study. The performance of the films in a photoelectrolytic solar cell with a flower-like morphology is compared with the films with normal morphology.