

Fabrication of Cu₂O Homojunction Solar Cell

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Cu₂O, a natural p-type semiconductor with a narrow band gap of 2 eV, is an attractive material for photovoltaic devices because of its nontoxicity and low production cost. In early investigations, p-Cu₂O/metal Schottky junctions or p-Cu₂O/n-type semiconductor heterojunctions were reported due to the absence of n-Cu₂O. Cu₂O homojunction attracts much attention with the invention of possibility of growth of the n-type Cu₂O in 1986 by the method of electrodeposition. Recently, p-n Cu₂O homojunction solar cells were fabricated by the electrochemical deposition of p-Cu₂O layer, followed by n-Cu₂O layer, in which the highest cell efficiency was reported to be 1.06%. However, performances of reported Cu₂O homojunction solar cells are poor compared to the theoretical efficiency of 12%. It has been understood that one of the options to improve the Cu₂O homojunction solar cell would be the formation of p- layer on top of the n-layer. In this study, the possibility of consecutive electrodeposition of p-Cu₂O layer on n-Cu₂O layer was examined to fabricate n-p Cu₂O homojunction , which has not been reported earlier.

The electrodeposition of Cu₂O was studied in a three electrode electrochemical cell, under a potentiostatic condition of -200 mV Vs Ag/AgCl at 55° C. n-Cu₂O films were cathodically deposited on Ti substrates in an aqueous solution of 0.1 M sodium acetate and 0.01 M cupric acetate for 60 min. Prior to the deposition of n-Cu₂O, the solutions were adjusted to a pH 6.12 of using HCl. In order to fabricate an n-p homojunction, the electrodeposition of p-Cu₂O was carried out on top of the previously deposited n-Cu₂O layer. p-Cu₂O was electrodeposited in an aqueous solution of 0.1 M sodium acetate and 0.001 M cupric acetate for 40 min. n-p Cu₂O homojunction was characterized by using dark and light current-voltage measurements and spectral response measurements in a PEC containing 0.1 M sodium acetate solution.

Dark and light current-voltage measurements and spectral response measurements reveal that the photoactivity of the device enhances due to the formation of n-p Cu₂O homojunction.

In conclusion, the study reveals the possibility of fabrication of n-p Cu₂O homojunction by electrodeposition.