Cu_2O Homojunction Solar Cell

Gunawardhana L.K.A.D.D.S. [1*], Wijesundera R.P. [1] and Siripala W. [1]

[1]Department of Physics, University of Kelaniya, Kelaniya
**dilanishanika@gmail.com*

Abstract

Cu_2O is a natural p-type semiconductor with a narrow band gap of 2 eV, which is an attractive material for photovoltaic devices because of its nontoxicity and low production cost. Cu_2O homojunction attracts much attention with the invention of possibility of growth of the n-type Cu_2O by the method of electrodeposition. Although electrodeposited p-n homojunction Cu_2O (metal substrate/p-Cu_2O/n-Cu_2O) solar cells were reported earlier, n-p homojunction Cu_2O (metal substrate/n-Cu_2O/p-Cu_2O) solar cells are very limited in the literature. This solar cell structure is very important when exploring the possibilities to improve the efficiencies of reported Cu_2O homojunction solar cells.

In this study, open circuit voltage, short circuit current, dark and light current-voltage characteristics and spectral response measurements were employed to investigate the possibilities of fabrication of n-p homojunction Cu_2O solar cell by electrodeposition technique. Different deposition conditions were adopted to grow and optimize the n-type and p-type Cu_2O films. n-Cu_2O thin films were electrodeposited on Ti substrate using an acetate bath of pH 6.1, where the resulted films produced only the n-type photoresponse in a PEC. Subsequently, a p-Cu_2O thin film was elecrodeposited on Ti/n-Cu_2O electrode using an acetate bath with a cupric ion concentration of 0.001 M. Since the fabricated n-p homojunction generates high resistance, $(NH_4)_2S$ vapour treatment was carried out by simply holding the n-p Cu_2Ohomojunction film face down above a beaker containing 20 vol. % $(NH_4)_2S$ solution. Photoactive measurements revealed that sulphur passivation of p-Cu_2O in n-p homojunction enhance the performance of the solar cell.

This study reveals that an efficient Cu_2O n-p homojunction solar cell can be fabricated by consecutive electrodeposition of an n-Cu_2O thin film followed by a p-Cu_2O thin film using an acetate bath. Sulphur passivation of p-Cu_2O reduces the resistivity of electrodeposited Cu_2O n-p homojunction thin film solar cells and thereby photoactivity of Cu_2O n-p homojuncton solar cells can be improved.

Key words : Electrodeposited Cu_2O thin films, Improved n-type photoactivity, n-p homojunction solar cells