Abstract No: PO-33 **Physical Sciences**

Fabrication of Cu_2O homojunction thin films for photovoltaic applications

F. S. B. Kafi, K.M.D.C. Jayathilaka, R. P. Wijesundera* and W. Siripala

Department of Physics, Faculty of Science,
University of Kelaniya, Sri Lanka
**Email: palitha@kln.ac.lk*

Environmentally friendly cuprous oxide (Cu_2O) is an attractive cost effective material for developing photovoltaic devices due to its astounding properties. Interestingly, the fabrication of low cost Cu_2O homojunction devices is possible due to Cu_2O is abundant and the ability of forming the p-Cu_2O and n-Cu_2O thin films using cost effective electrodeposition technique. Indeed, it is necessary to optimize p-n junction devices by varying deposition parameters. Vividly, the pH of the deposition bath controls the quality of the electrodeposited Cu_2O thin films. Hence, it is important to optimize the pH value of the bath use for the electrodeposition of n-Cu_2O and p-Cu_2O films for developing Cu_2O based devices. In this study, Cu_2O thin film homojunction device was fabricated using a successive deposition of an n-Cu_2O film followed by a p-Cu_2O film, in two different baths; acetate and lactate respectively. The Cu_2O homojunction was fabricated on a Ti substrate by the two-step potentiostatic electrodeposition process. A set of n-Cu_2O thin films were electrodeposited on Ti substrate in a three electrode aqueous electrochemical cell containing 0.1 M sodium acetate and 0.01 M cupric acetate at potential of -200 mV vs. Ag/AgCl electrode, bath temperature of 55 °C and the film deposition time of 1 hour at two different pH values of n-Cu_2O thin film deposition baths; 6.1 and 6.5. Then to optimize the Cu_2O homojunction, Ti/n-Cu_2O/p-Cu_2O junction was fabricated by consequently electrodepositing p-Cu_2O thin film on n-Cu_2O film by changing the pH value from 7.0 to 13 of the p-Cu_2O thin film deposition bath. The electrochemical bath used for the deposition of p-Cu_2O thin films contained 3 M lactic acid, 0.4 M copper sulfate and 4 M NaOH. pH of the deposition baths were controlled by adding NaOH and HCl. Then Ti/n-Cu_2O/p-Cu_2O/Au structure was fabricated by sputtering Au on the resulted Cu_2O homojunction. The highest photoactive film observed for Ti/n-Cu_2O/p-Cu_2O/Au structure that was fabricated at pH values of 6.1 and 11.0 for n-Cu_2O and p-Cu_2O deposition baths respectively. The observed V_{OC} and J_{SC} values for the optimum Ti/n-Cu_2O/p-Cu_2O/Au structure was 344 mV and 1.13 mA/cm^2 respectively, under AM 1.5 illumination. The resulted high V_{OC} and I_{SC} values evident for the possibility of fabrication of Cu_2O homojunction devices by employing consecutive electrodeposition of an n-Cu_2O layer followed by a p-Cu_2O layer using the relevant baths at different growth conditions. Promisingly, fabricated Cu_2O homojunction may further improved by surface treatments and optimizations, to produce high efficient Cu_2O homojunction devices.

Keywords: Cuprous oxide, Electrodepostion, Homojunction, Thin film solar cell

Acknowledgement: *Financial assistance from National Research Council through research grant NRC 15-41.*