The influence of deposition temperature of *n*-type ALD buffer layer on device characteristics of electrodeposited Cu_2O thin film solar cells

Jae Yu Cho[1], Tran Hieu Man[1], Jaeyeong Heo[1*]

[1]*Department of Materilals Science and Engineering and Optoelectronics Convergence Research center, Chonnam National University, Gwangju, Republic of Korea*
fiarkan@naver.com

Beside several advantages, the PV power generation as a clean energy source, is still below the supply level due to high power generation cost. Therefore, the interest in fabricating low-cost thin film solar cells is increasing continuously. Cu_2O, a low cost photovoltaic material, has a wide direct band gap of ~2.1 eV has along with the high theoretical energy conversion efficiency of about 20%.[1,2] On the other hand, it has other benefits such as earth-abundance, low cost, non-toxic, high carrier mobility (100 cm^2/Vs).[2,3] In spite of these various advantages, the efficiency of Cu_2O based solar cells is still significantly lower than the theoretical limit as reported in several literatures. One of the reasons behind the low efficiency of Cu_2O solar cells can be the formation of CuO layer due to atmospheric surface oxidation of Cu_2O absorber layer.[2,4]

In this work, atomic layer deposition method was used to remove the CuO layer that formed on Cu_2O surface. First, Cu_2O absorber layer was deposited by electrodeposition. On top of it buffer (ZnO) and TCO (AZO) layers were deposited by atomic layer deposition and rf-magnetron sputtering respectively. Figure 1 is SEM image of Cu_2O solar cell structure. We fabricated the cells with a change in the deposition temperature of buffer layer ranging between 80 ^oC to 140 ^oC. Finally, we compared the performance of fabricated solar cells, and studied the influence of buffer layer deposition temperature on Cu_2O based solar cells by J-V and XPS measurements.

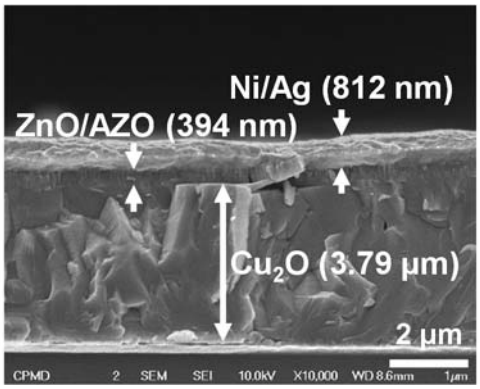

Figure 1. SEM cross-sectional images of the Cu_2O solar cell

References:
[1] T. Minami, Y. Nishi, T. Miyata, and J. I. Nomoto, Appl. Phys. Express, **4(6)**, 62301 (2011).
[2] A. Mittiga, E. Salza, F. Sarto, M. Tucci, and R. Vasanthi, Appl. Phys. Lett., **88**, 163502 (2006).
[3] Y. S. Lee, J. Heo, S. C. Siah, J. P. Mailoa, R. E. Brandt, S. B. Kim, R. G. Gordon, and T. Buonassisi, Energy Environ. Sci., **6(7)** 2112–2118 (2013).
[4] Y. S. Lee, D. Chua, R. E. Brandt, S. C. Siah, J. V. Li, J. P. Mailoa, S. W. Lee, R. G. Gordon, and T. Buonassisi, Adv. Mater., **26(27)**, 4704–4710 (2014).