Type of presentation: Invited

Single-Walled Carbon Nanotubes and Graphene as Hole Transport Layer and Electrode for Solar Cells

Shigeo Maruyama[1], Kehang Cui[1], Takaaki Chiba[1], Il Jeon[2], Xiao Chen[1], Rong Xiang[1], Shohei Chiashi[1], Esko I. Kauppinen[3], Yutaka Matsuo[2]

[1] *Department of Mechanical Engineering, The University of Tokyo, Tokyo, Japan*
[2] *Department of Chemistry, The University of Tokyo, Tokyo, Japan*
[3] *Department of Applied Physics, Aalto University School of Science, Espoo, Finland*

We investigate the application of single-walled carbon nanotubes (SWNTs) and graphene as hole transport layer and transport electrode in various kinds of solar cells including honeycomb-structured SWNTs-Si solar cell [1], dry-deposited SWNTs-Si solar cell [2], graphene-Si solar cells, organic solar cell (OSC) [3] and perovskite-type solar cells [4]. Using millimeter-scale monocrystalline single-layer graphene and honeycomb-structured SWNT network, the nanocarbon-Si solar cell demonstrated the air-stable power conversion efficiency (PCE) of 11.6% before any intentional doping process (Fig. 1). For organic solar cells, the SWNT/MoOx/PEDOT:PSS nanocomposite was proposed and developed as hole transport layer and electrode replacing ITO. Using PTB7/PC71BM mixture as active materials, the PCE of 6% was obtained for on glass substrate and 3.89% on flexible PET substrate. The hole transport and cathode function of SWNTs was also demonstrated in perovskite solar cells with over 9% PCE. The dual functional behavior of SWNT and graphene will be discussed.

.

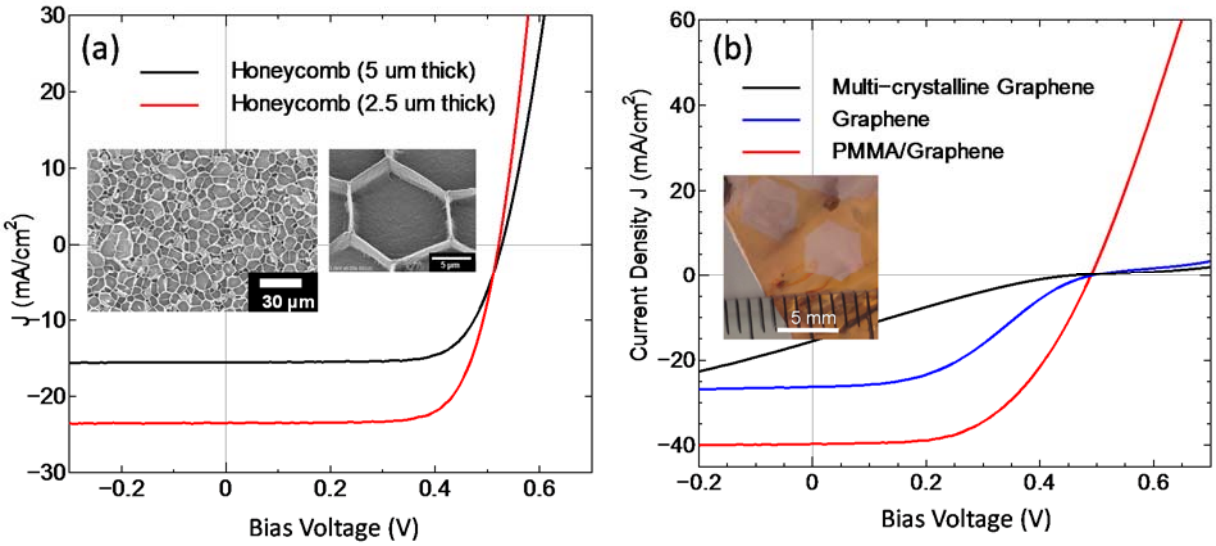

Figure 1. J-V curves of nanocarbon-Si solar cells. (a) Honeycomb structured SWNT-Si solar cells. (b) Graphene-Si cells. Single-crystal graphene with PMMA has more than 11% PCE.

[1] K. Cui, T. Chiba, S. Omiya, T. Thurakitseree, P. Zhao, S. Fujii, H. Kataura, E. Einarsson, S. Chiashi, S. Maruyama, J. Phys. Chem. Lett., 4 (2013), 2571.

[2] K. Cui, A. S. Anisimov, T. Chiba, S. Fujii, H. Kataura, A. G. Nasibulin, S. Chiashi, E. I. Kauppinen, S. Maruyama, J. Mater. Chem. A, 2 (2014) 11311.

[3] I. Jeon, K. Cui, T. Chiba, A. S. Anisimov, A. G. Nasibulin, E. I. Kauppinen, S. Maruyama, Y. Matsuo, submitted.

[4] T. Chiba, T. Sakaguchi, A. G. Nasibulin, E. I. Kauppinen, R. Xiang, S. Chiashi, S. Maruyama, to be submitted.

Please submit this abstract at your earliest convenience to wonton2015@uni-wuerzburg.de, but no later than February 15.