Organic Thin-film Solar Cells

Masahiro Hiramoto

Institute for Molecular Science, Myodaiji, Okazaki 444-8787, Japan

e-mail address: hiramoto@ims.ac.jp

Organic EL television was commercialized last year. Next target of organic electronics is organic solar cell. The present lecture includes fundamental science and history of organic solar cells, concept of organic p-i-n cells [1], nanostructure design of codeposited i-interlayer [2], ultra-high purification of organic semiconductors [3], and future prospects of organic solar cells.

High-purified organic semiconductors can be obtained by forming large single crystals (Fig. 1). p-i-n cells incorporating seven-nine (7N) C_{60} showed the world record conversion efficiency of 5.3% (Fig. 2). Essence of high efficiency is the utilization of entire visible light of solar spectrum without decreasing fill factor by the black-colored cell incorporating very thick (1 μm) C_{60}:H_2Pc *i*-interlayer.

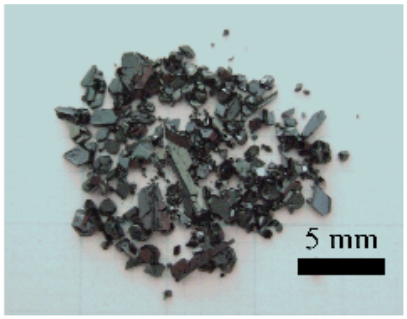

Fig. 1 Single crystals of seven-nine (99.99999, 7N) C_{60}.

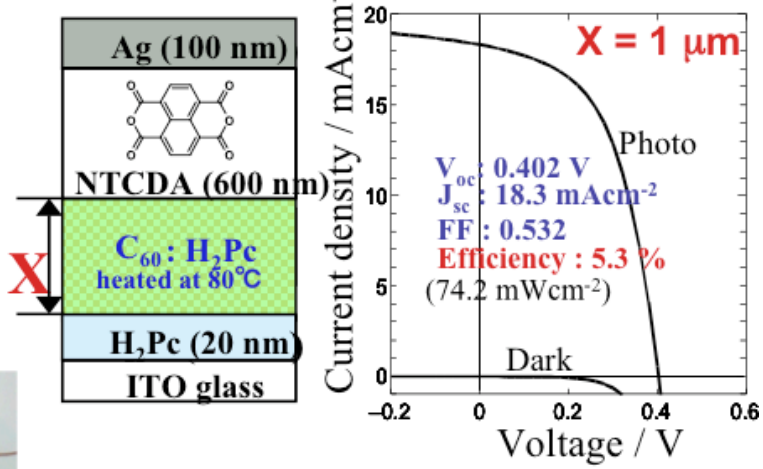

Fig. 2 p-i-n cell structure and current-voltage characteristics of p-i-n cell incorporating 7N-C_{60}.

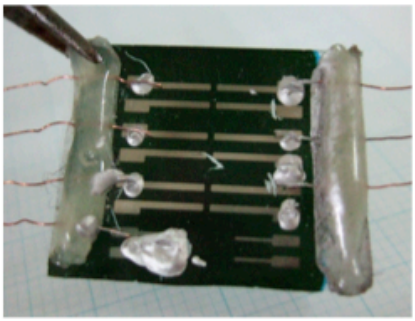

Fig. 3 p-i-n cell having 1 μm-thick C_{60}:H_2Pc codeposited i-inerlayer, which showed efficiency of 5.3%.

[1] M. Hiramoto, H. Fujiwara, M. Yokoyama, *J. Appl. Phys*., **72**, 3781 (1992).
[2] K. Suemori, T. Miyata, M. Yokoyama, M. Hiramoto, *Appl. Phys. Lett.,* **86**, 063509 (2005).
[3] M. Hiramoto, Proceedings of SPIE Vol. 7052, Organic photovoltaics IX, San Diego, CA, 12-14 Aug. (2008).