Extended Abstracts of the 2015 International Conference on Solid State Devices and Materials, Sapporo, 2015, pp652-653

Bandgap Science for Organic Solar Cells

Masahiro Hiramoto[1,2]

[1]Institute for Molecular Science, 5-1 Higashiyama, Myodaiji, Okazaki, Aichi 444-8787, Japan
Email:hiramoto@ims.ac.jp
[2]JST, CREST, 5 Sanbancho, Chiyoda-ku, Tokyo 102-0075, Japan

Recently, conversion efficiency of organic thin-film solar cell exceeded 10%. In 1991, I proposed *pin* junction incorporating co-deposited *i*-interlayer consisting of two kinds of organic semiconductors (so-called bulkheterojunction), which is an indispensable for present organic solar cells [1,2].

In this talk, bandgap science for organic thin-film solar cells [3], including (i) *pn*-control of organic semiconductors by impurity doping (Fig. 1) [4-6], (ii) Doping mechanism investigated by Kelvin band-mapping (Fig. 2)[7], (iii) *pn*-control of the photovoltaic co-deposited films [8,9], (vi) Ionization sensitization of doping [10], (vi) ppm-doping effects in the organic photovoltaic cells, will be presented

References

[1] M. Hiramoto et al., Appl. Phys. Lett. **58** (1991) 1062.
[2] M. Hiramoto et al., J. Appl. Phys. **72** (1992) 3781.
[3] M. Hiramoto, M. Kubo, Y. Shinmura et al., Electronics **3** (2014) 351.
[4] M. Kubo et al., Appl. Phys. Lett. **98** (2011) 073311.
[5] M. Kubo et al., AIP Advances **1** (2011) 032177.
[6] Y. Shinmura et al., AIP Advances **2** (2012) 032145.
[7] Y. Shinmura et al., Appl. Phys. Express **7** (2014) 071601.
[8] N. Ishiyama et al., Appl. Phys. Lett. **99** (2011) 133301.
[9] N. Ishiyama et al., Org. Electron. **14** (2013) 1793.
[10] Y. Shinmura et al., Appl. Phys. Lett. **105** (2014) 183306.

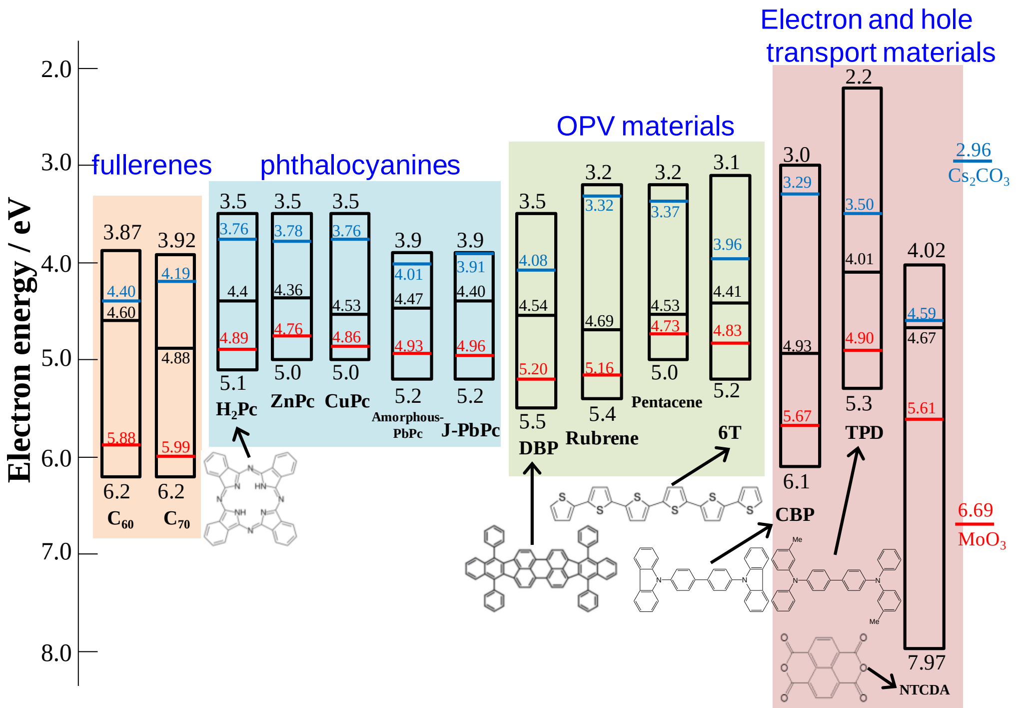

Fig1. Energy diagrams of various organic semiconductor films. The black, red, and blue lines show the E_F for non-doped, MoO_3(acceptor)-doped, and Cs_2CO_3(donor)-doped films. Doping concentration is 3,000 ppm.

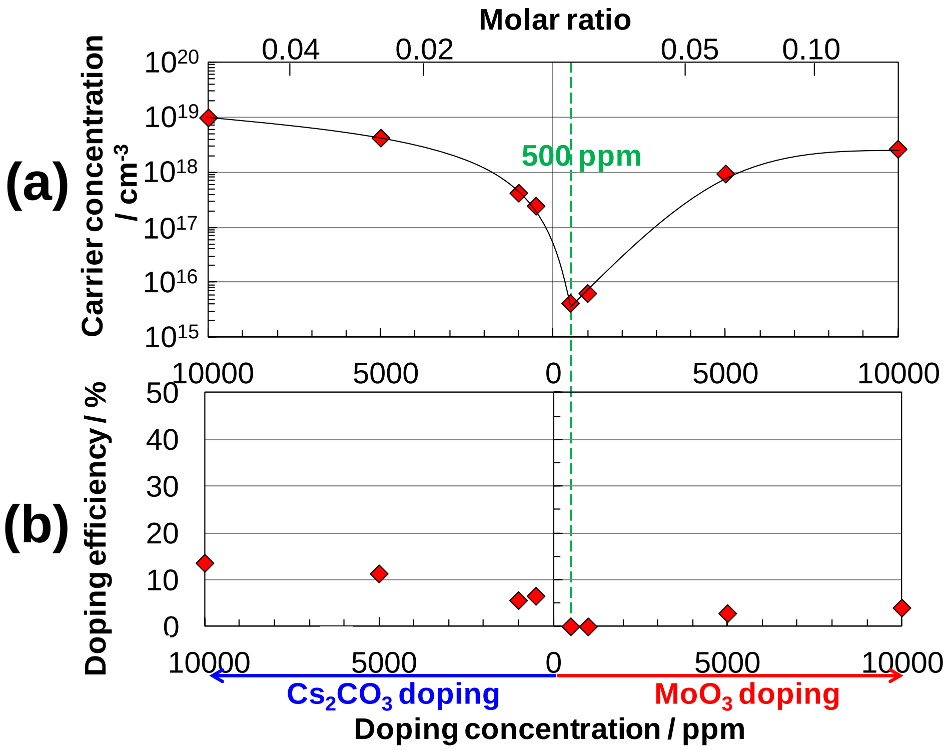

Fig. 2 Dependence of carrier concentration (a) and doping efficiency (b) on doping concentration of Cs_2CO_3 or MoO_3 measured by Kelvin band mapping.