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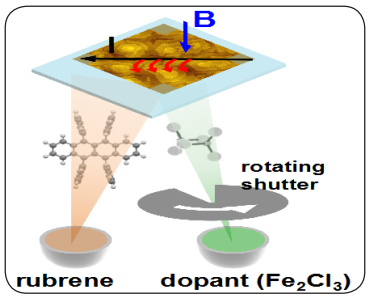
Hall effect in bulk-doped organic single crystals

Controlling "holes" and "electrons" responsible for electric conduction of p-type and n-type semiconductors by doping had been the central technology inorganic single crystal electronics represented by silicon chips and solar cells. We have reported the effects of impurity doping at ppm level in photovoltaic organic semiconductors. The number of carriers created by doping and their mobility can be freely evaluated by "Hall effect measurement" using a magnetic field. However, in the field of organic electronics, no one has ever attempted to dope impurities into an organic single crystal itself nor measure its Hall effect. Recently, we have combined the rubrene organic single crystal growth technique with our original ultra-slow deposition technique of 10-9 nm/s, which includes a rotating shutter having aperture and for the first time, we have succeeded in producing the ppm-level doped organic single crystal and have detected its Hall effect signal. The present results have the meaning of dawn of organic single crystal electronics similar to the silicon single crystal electronics.



Ultra-slow co-deposition technique to produce the doped rubrene single crystal for Hall effect measurements.

Recent Publications

1. Kubo M et al. (2011) Conduction type control of fullerene films from n- to p-type by molybdenum oxide doping. Appl. Phys. Lett. 98(7):073311.
2. Shinmura Y et al. (2014) Mapping of band bending for doped C60 films. Appl. Phys. Express. 7:071601.
3. Ishiyama N et al. (2011) Doping-based control of the energetic structure of photovoltaic co-deposited films. Appl. Phys. Lett. 99:133301.
4. Ishiyama N et al. (2011) Tandem organic solar cells formed in co-deposited films by doping. 14(7):1793-1796.
5. Shinmura Y et al. (2014) Ionization sensitization of doping in co-deposited organic semiconductor films. Appl. Phys. Lett. 105:183306.

Biography

Masahiro Hiramoto received a PhD in Chemistry from Osaka University, Japan in 1986. He started his research on organic semiconductors and organic solar cells in 1988 at the Graduate School of Engineering from the same university. He joined the Institute for Molecular Science, Japan as a Professor in 2008. He has published over 130 papers. He is an Inventor of the blended junction and tandem junction for organic solar cells.

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