

Recent Works in Nanomaterials for High Performance Organic Solar Cells

Won Ho Jo

Department of Materials Science and Engineering, Seoul National University,
Seoul 151-742, Korea

Advantages of organic solar cells (OSCs) include low cost, ease of fabrication and the potentials for flexible, large area solar cells. Recent progress for the past few years shows that the power conversion efficiency (PCE) has continuously increased to its current value exceeding 8%. However, still lower efficiency and poorer long term stability than Si-based solar cells limit the commercialization of OSCs. Therefore, further improvement in the device performance of OSCs is needed.

Several approaches has been proposed to improve the PCE of OSCs: (i) synthesis of low bandgap conjugated organic molecules to harvest the solar spectrum more effectively [1], (ii) synthesis of semi-conducting organic molecules with deep HOMO levels to enhance V_{OC} [2], (iii) synthesis of conjugated organic molecules with planar structure to afford high hole mobility [3], (iv) control of the vertical composition gradient across active layer to reduce the charge recombination and thus to increase the fill factor [4], (v) development of effective hole (or electron) transport layer-materials [5,6], (vi) synthesis of new fullerene derivatives as acceptor material, and others.

The need to develop new fabrication method compatible with continuous solution process has also been emerged. Although spin coating is very useful for fabricating very thin and homogeneous film and successful for controlling the film thickness, the spin-coating process has several detrimental problems in its application to mass production. In order to overcome these problems, a novel coating process, roller printing, has recently been developed in our laboratory [7].

Development of flexible and transparent electrodes is essential for fabrication of flexible organic solar cells. For the purpose, we developed transparent, flexible and highly conductive thin films from single-walled carbon nanotubes [8] and graphene [9] by using a non-ionic surfactant [10] for dispersing the carbon nanomaterials in aqueous or organic solvents, respectively.

References

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Technical program

The 4th WCU (World Class University) Symposium on Hybrid Materials



January 24-25, 2013
The Ocean Resort, Yeosu, Korea

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Department of Materials Science and Engineering
Seoul National University
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Schedule

January 24, Thursday

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13:00 – 13:50	Lunch
Session I Chair : Prof. Seong-Hyeon Hong	
13:50 – 14:00	Opening Remarks Prof. Jae-Ryoun Youn
14:00 – 14:30	Recent Works in Nanomaterials for High Performance Organic Solar Cells Prof. Won Ho Jo
14:30 – 15:00	An Odyssey to Experimental Verification of the Onsager Reciprocity in Flow of Charge Carriers in Solids Prof. Han-Il Yoo
15:00 – 15:30	Silicon Carbide as a Power Energy Semiconductor Prof. Hyeong Joon Kim
15:30 – 16:00	Nanofabrication for Bio-Information Technology Prof. Ki-Bum Kim
Coffee Break	

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Session II Chair : Prof. Seong-Hyeon Hong

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Introduction of SK Innovation R&D Activities on Materials and Devices

Young Keun Lee (Science Advisory Board Leader, SK innovation Global Technology)

17:00 – 17:30

Research and Development Status of CIGS Solar Cell in SKIGT

Jin Hyock Kim (Advanced Materials Lab, Performance Materials R&D Center, SK innovation Global Technology)

17:30 – 18:00

Overall Discussion

18:00 – 20:00

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Discussion on Hybrid Materials

Hosted by Prof. Young-Woon Kim

January 25, Friday

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Breakfast

8:50 – 11:00

Wrap-up Meeting

Hosted by Prof. Jae-Ryoun Youn