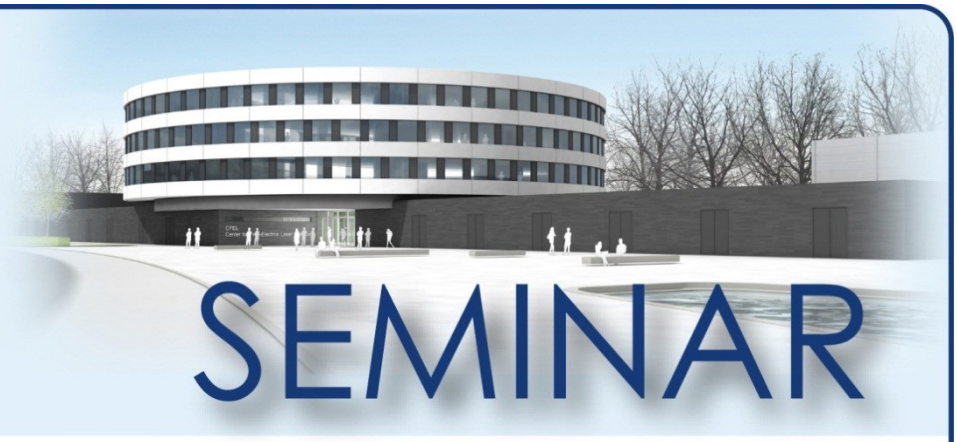
CFEL SCIENCE



SEMINAR

13th November, 2014 - 13:00

bldg. 99, seminar room IV (O1.111)

Young Dok Kim

Dept. of Chemistry, Sungkyunkwan University, Suwon, Rep. of Korea

Modulation of interface of metal oxide and semiconductive organic polymers using atomic layer deposition

Organic photovoltaic devices basically contain metallic electrodes and layers consisting of various organic species (active layer), in which light is harvested and the resulting electron-hole pairs are separated. In addition, inorganic buffer layers (either electron- or hole-collecting layers) can be inserted between electrodes and organic active layers for selective collections of electrons or holes and thereby quenching electron-hole recombination in the organic active layer. Recently, it was found that the performance of the organic solar cell can be dependent of the interface structure of organic active and inorganic buffer layers. Atomic layer deposition (ALD) was used for modifying surface structure of the buffer layers, and the performance and the stability of the organic photovoltaic were changed as a function of the thickness of the ALD layers. Using various analysis methods such as photoluminescence, atomic force microscopy and photoelectron spectroscopy, the origin of the change in the photovoltaic performance by altering the thickness of the ALD layer was studied, and the results will be presented in the first part of my presentation.

The second part of my presentation will be devoted to the oxidation behaviors of semiconductive organic polymers on bare and TiO_2-modified ZnO surfaces. Degradations of polymers under dry or humid atmospheric conditions and visible light illuminations were studied using photoelectron spectroscopy and the results will be highlighted. Moreover, the oxidation behavior of the polymer was found to be altered by the TiO_2-modification of ZnO surface, and the reason of the different oxidation behaviors of the polymer of different oxide surfaces will be discussed.

References

1) Ultrath in TiO_2 films on ZnO electron-collecting layers of inverted organic solar cell, Journal of Physical Chemistry C 115(43) 21517-21520 NOV 3 2011.
2) Organic Solar Cell Fabricated by One-Step Deposition of a Bulk Heterojunction Mixture and TiO_2/NiO Hole-Collecting Agents, Journal of Physical Chemistry C 116(29) 15348-15352 2012 JUL 26 2012.
3) Organic photovoltaics with high stability sustained for 100 days without encapsulation fabricated using atomic layer deposition, Physics Status Solidi Rapid Research Letters 6(5) 196-198 MAY 2012.
4) Towards Fabrication of High-Performing Organic Photovoltaics: New Donor-Polymer, Atomic Layer Deposited Thin buffer layer and Plasmonic Effects, Energy and Environmental Science 5(12) 9803-9807 NOV 14 2012.
5) Surface modification of a ZnO electron-collecting layer using atomic layer deposition to fabricate high-performing inverted organic photovoltaics, ACS Applied Materials and Interfaces *5* (17) 8718–8723 SEP 11 2013.
6) Role of additional PCBM layer between ZnO and photoactive layers in inverted bulk-heterojunction solar cells, Scientific Report 4, 4306 MAR 07 2014.
7) Initial Stage of Photo-Induced Oxidation of Poly(3-hexylthiophene-2,5-diyl) Layers on ZnO under Dry and Humid Air, Journal of Physical Chemistry C *118* (7) 3483–3489 FEB 20 2014.

Host: Wolfgang Eberhardt