

Abstract Submitted  
for the MAR12 Meeting of  
The American Physical Society

**Controlling Side Chain Density of Electron Donating Polymers for Improving  $V_{OC}$  in Polymer Solar Cells** B.J. KIM, K.H. KIM, C.H. CHO, H. KANG, KAIST, S.C. YOON, KRICT — The ability to tune the LUMO/HOMO levels of electroactive materials in active layer of polymer solar cells is critical in controlling their optical and electrochemical properties because the HOMO and LUMO offsets between the polymer donor and the electron acceptor strongly affect charge separation and the open circuit voltage ( $V_{OC}$ ) of a solar cell. Here, we developed two series of electroactive materials for improving  $V_{OC}$  in polymer solar cells. First, we enable facile control over the number of solubilizing groups ultimately tethered to the fullerene by tuning the molar ratio between reactants from 1:1 to 1:3, thus producing *o*-xylynyl C<sub>60</sub> mono-, bis-, and tris-adducts (OXCMA, OXCBA, and OXCTA) as electron acceptors with different LUMO levels. As the number of solubilizing groups increased,  $V_{OC}$  values of the P3HT-based BHJ solar cells increased from 0.63, 0.83, to 0.98 V. Second, we present a series of novel poly[3-(4-n-octyl)phenylthiophene] (POPT) derivatives (POPT, POPTT, and POTQT) as electron donors with different side-chain density. As a result of lower HOMO levels by decrease in the side-chain density of the polymers, the devices consisting of POPT, POPTT, and POPQT with PCBM showed increased  $V_{OC}$  values of 0.58, 0.63, and 0.75 V, respectively.

B.J. Kim  
KAIST

Date submitted: 07 Nov 2011

Electronic form version 1.4