

Abstract Submitted  
for the MAR09 Meeting of  
The American Physical Society

**Improved polythiophene conductivity by thermal crosslinking for solar cell applications** I.R. GEARBA, C.-Y. NAM, R. PINDAK, C.T. BLACK — Organic photovoltaic device power conversion efficiencies are limited in part by low charge mobility within the constituent active layer. For example, the p-type polythiophene polymers used in the highest efficiency organic photovoltaic devices have transverse hole mobilities of only  $10^{-4}$ - $10^{-5}$   $\text{cm}^2/\text{V-s}$ , despite showing significantly higher values ( $\sim 0.1$   $\text{cm}^2/\text{V-s}$ ) in a lateral FET geometry. This mobility anisotropy is caused by poor overlap of  $\pi - \pi$  orbitals in the transverse direction, which impedes charge hopping between polymer chains. We have improved the transverse hole conductivity by as much as three times by incorporating the radical initiator di-tert-butyl peroxide into polythiophene thin films. The initiator promotes thermal crosslinking upon annealing at 170C. Crosslinked polythiophene films maintain a similar absorption spectrum to the uncrosslinked material. Grazing incidence X-ray measurements correlate film structural changes to the measured electronic properties, and reveal two possible mechanisms for increased  $\pi - \pi$  overlap in crosslinked films. We have increased the power conversion efficiency of planar photovoltaic devices composed of p-type polythiophene and n-type C60 by approx three times (from 0.09% to 0.27%) by crosslinking the polythiophene material. Moreover, crosslinked polythiophene films are rendered insoluble and thus amenable to the further material processing.

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Date submitted: 21 Nov 2008

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