Supporting Information

Graphene oxide hole transport layers for large area, high efficiency organic solar cells

Chris. T. G. Smith, Rhys. W. Rhodes, Michail. J. Beliatas, K. D. G. Imalka Jayawardena, Lynn. J. Rozanski, Chris. A. Mills, and S. Ravi. P. Silva.

FTIR spectrum

Figure S1. FTIR spectrum of graphene oxide obtained via the Hummer's process

Figure S1 shows the GO FTIR spectra. Characteristic peaks include the broad peak at ~3400 cm⁻¹, which can be attributed O-H stretching vibrations. The peaks at 1725 and 1618 cm⁻¹ are assigned (respectively) to C=O stretching vibrations (from carbonyl and carboxylic groups) and the C=C aromatic rings present in the graphitic skeleton. An indication of a peak can be seen at ~1225 cm⁻¹, which can be attributed to C-OH stretching vibrations, and a final peak is visible at 1049 cm⁻¹, which is attributed to C-O stretching vibrations of epoxy or alkoxy groups.

Conduction mechanisms

Figure S2. I/V data fitted into conduction mechanism plots fit using dark current data for ITO / HTL / PCDTBT:PC₇₀BM / BCP / Al devices. Fits to the data for (a) space charge limited current, (b) Schottky , (c) Fowler Nordheim and (d) Poole Frenkel conduction mechanisms are given for the solar cell with no HTL (data: circles, fit: dashed line), and with PEDOT:PSS (down triangles, dash-dot-dot line) and GO (up triangle, solid line) HTLs. For clarity, only every third data point is plotted.

Figure S3. . I/V data fitted into conduction mechanism plots fit using dark current data for an ITO / HTL / PCDTBT:PC₇₀BM / TiO_x / Al device. Fits to the data for (a) space charge limited current, (b) Schottky, (c) Fowler Nordheim and (d) Poole Frenkel conduction mechanisms are given for the solar cell with no HTL (data: circles, fit: dashed line), and with PEDOT:PSS (down triangles, dash-dot-dot line) and GO (up triangle, solid line) HTLs. For clarity, only every third data point is plotted.

Table SI. Comparative efficiency values for solar cells taken from the literature.

Device	PCE (%)	Comment
Al/ETL/PCDTBT:PCBM/GO/ITO	5.0	This work
Al/ETL/PCDTBT:PCBM/GO/ITO ^a	3.0	Direct comparison
Al/GO/PCDTBT:PCBM/HTL/ITO ^a	5.5	Inverted device
Al/P3HT:PCBM/GO/ITO ^b	3.7-4.0	P3HT active layer/ annealed GO HTL (250°C - 350°C)
Al/P3HT:PCBM/PEDOT:PSS/ITO ^b	3.8	P3HT active layer/ PEDOT:PSS HTL
Al(Li)/PTB7:PCBM/GO/ITO ^c	7.39	PTB7 active layer/ GO HTL
Al(Li)/PTB7:PCBM/PEDOT:PSS/ITO ^c	7.46	PTB7 active layer/ PEDOT:PSS HTL

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