# Power conversion efficiency enhancement in diketopyrrolopyrrole based solar cells through polymer fractionation

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#### **Supporting Information**

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- General experimental
- Solar cell device fabrication
- AFMs
- Blend XRD
- GPCs

### General

Number-average (Mn) and weight-average (Mw) molecular weights were determined with an Agilent Technologies 1200 series GPC in chlorobenzene at 80 °C, using two PL mixed B columns in series, and calibrated against narrow weight-average dispersity (Dw < 1.10) polystyrene standards. UV-vis absorption spectra were recorded on a UV-1601 Shimadzu UV-vis spectrometer. Atomic force microscopy (AFM) was carried out using a Dimension 3100 atomic force microscope in close contact (tapping) mode. Specular X-ray diffraction (XRD) was carried out using a PANalytical X'Pert PRO MRD diffractometer equipped with a nickel-filtered Cu-K $\alpha$ 1 beam and X'Celerator detector, using current I = 40 mA and accelerating voltage U = 40 kV.

#### Solar cell device fabrication

Bulk heterojunction solar cells with conventional and inverted architectures were fabricated using non fractionated, F1, F2 and F3 polymer as the donor material in the active layers by spin coating of a 1 : 2 polymer / PC[71]BM mixture from chloroform : o-dichlorobenzene (ODCB) (4:1). The external quantum efficiency (EQE) was used to correct the current density vs voltage data before extracting values.



Figure 1. (a) inverted and (b) conventional device architectures.

#### AFMs



**Figure 2.** AFM topography images (tapping mode,  $2 \times 2\mu m$ ) of polymer / fullerene blends with non-fractionated (NF), F1, F2 and F3 materials spin coated from a chloroform : *o*DCB mixture.



**Figure 3.** Neat polymer film AFM images for non fractionated, F1, F2 and F3 material (left) topography (right) phase images



**Figure 4.** Average domain size distributions for NF, F1, F2 and F3 materials determined by AFM.

**Blend XRD** 



**Figure 5.** Blend XRD of NF, F1, F2 and F3 materials, films fabricated using same conditions as in device fabrications.

## **Polymer GPCs**



Figure 6. Non normalized GPC elugram of material F1 in chlorobenzene.



Figure 7. Non normalized GPC elugram of material F2 in chlorobenzene.



Figure 8. Non normalized GPC elugram of material F3 in chlorobenzene.



Figure 9. Non normalized GPC elugram of non fractionated, F1, F2 and F3 materials.