Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supplemental Information: Additive Solution Deposition of Multi-layered Semiconducting Polymer Films for Design of Sophisticated Device Architectures

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S1 SLD Volume Balance

Calculated solvent volume fraction ($\phi_{solvent}$) from layer SLD obtained from fitting NR.

$$\phi_{solvent} = 1 - (\frac{\rho^L - \rho^S}{\rho^P \tau - \rho^S}) \tag{S1}$$

Table S1: Preliminary Profilometer thickness measurements of thin films deposited from same processing conditions and at the time the NR films were made.

Film	Layer	Thickness (nm)
Multilayer film	1st layer	75 ± 4
	2nd layer	39 ± 4
	3rd layer	47 ± 2
	4th layer	32 ± 4
Single Layer P3HT Film	NA	187 ± 8

Table S2: Scattering length densities of materials in model

Material	SLD ($10^{-6}\mathring{A}^{-2}$)
Air	0
Silicon	2.07
Silicon Oxide	3.47
P3HT	0.55
F4TCNQ	4.88
d-CB	4.91
d-AN	4.92

Where ρ^L is measured layer SLD, ρ^S is calculated solvent SLD based on density at room temperature. ρ^P is measured P3HT layer SLD from the pure P3HT sample and τ is a thickness normalization to correct the P3HT SLD to its expanded volume in the swollen state.

$$\tau = \frac{T^P}{T^{SP}} \tag{S2}$$

Where, T^P is the neutral P3HT layer thicknesses before swelling, and T^{SP} is the thickness in the solvent swollen state.

The solvent Volume Fraction for doped film

$$\phi_{solvent} = 1 - (\frac{\rho^L - \rho^S}{\rho^{DP}\gamma - \rho^S}) \tag{S3}$$

Where ρ^{DP} is the measured SLD of the doped polymer layer and γ is a thickness normaliza-

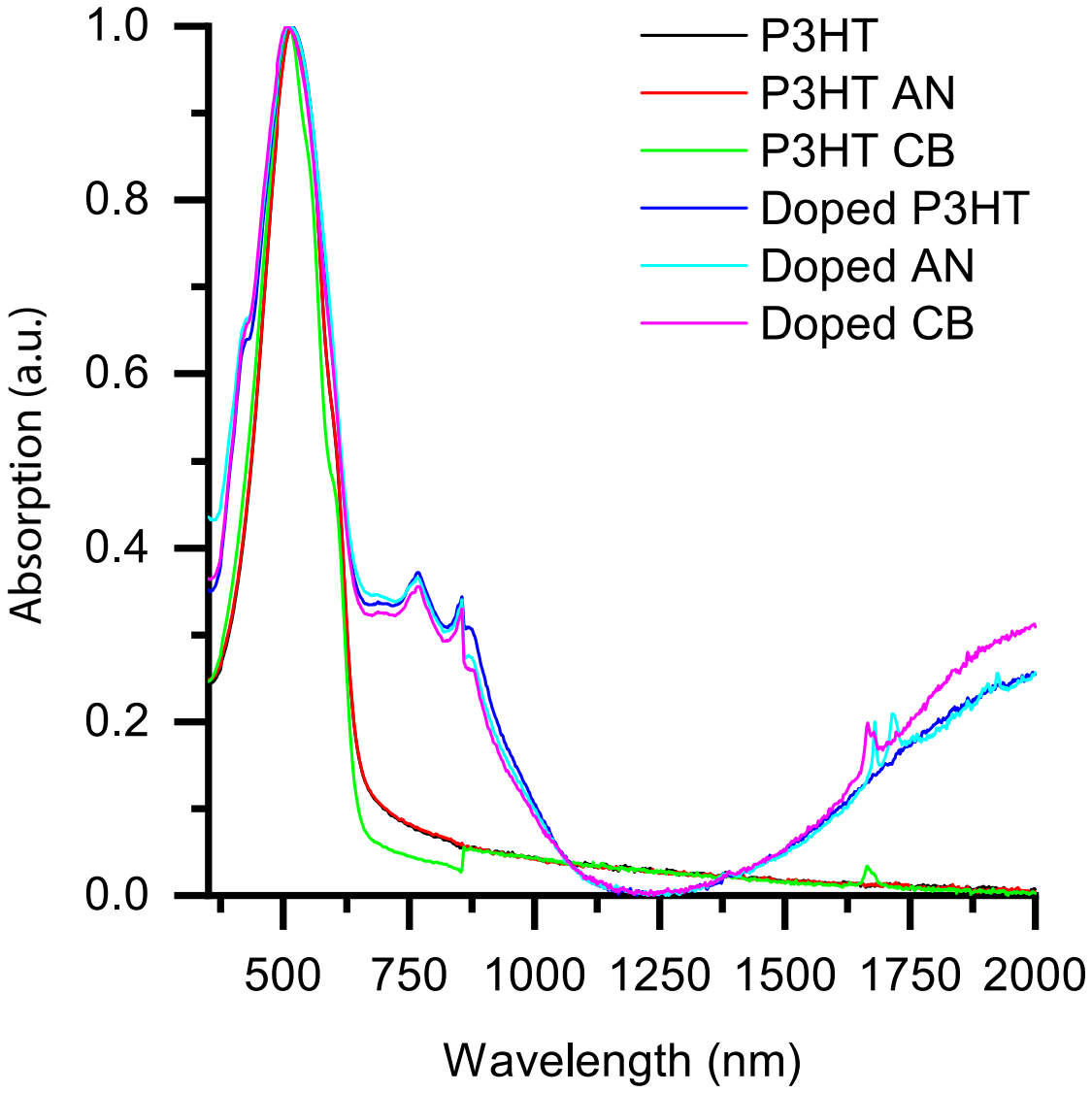

Figure S1: Normalized UV-Vis absorption profile of neat and doped P3HT films under saturated AN and CB vapor environments

tion to correct the Doped P3HT SLD to its expanded volume in the swollen state.

$$\gamma = \frac{T^{DP}}{T^{SDP}} \tag{S4}$$

Where, $T^{D}P$ is the Doped P3HT layer thicknesses before swelling, and T^{SDP} is the thickness

in the solvent swollen state.

S2 Grazing Incidence Wide Angle X-ray Scattering

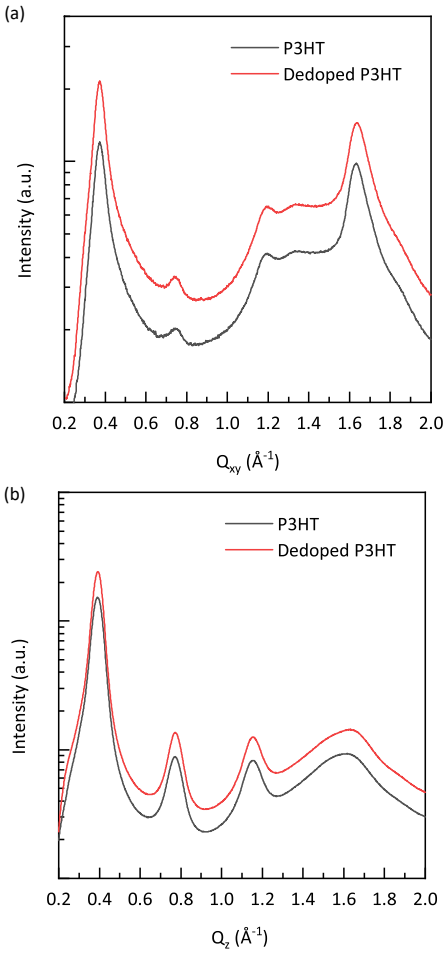

Figure S2: (a) In-plane (Q_{xy}) and (b) out-of-plane (Q_z) GIWAXS of neat and dedoped P3HT film.

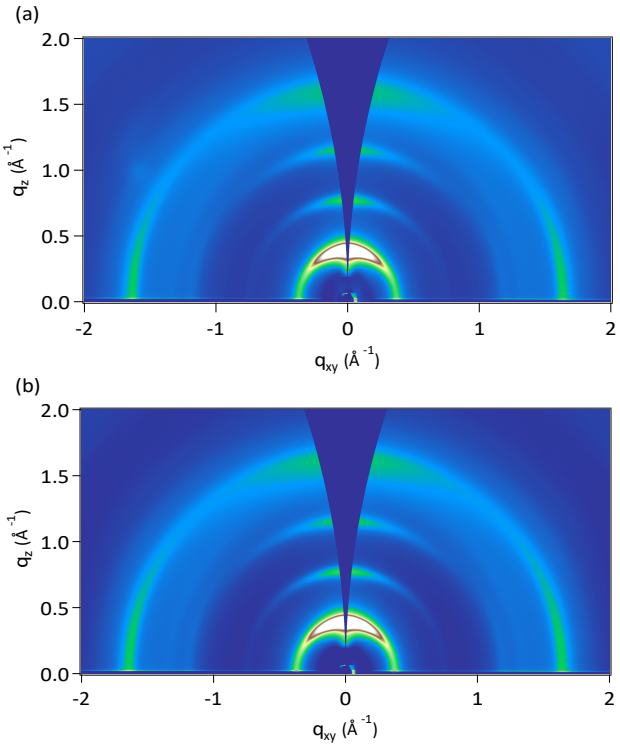

Figure S3: 2D GIWAXS patterns of (a) neat P3HT and (b) chemically dedoped P3HT. (Note: Q_z is approximate)

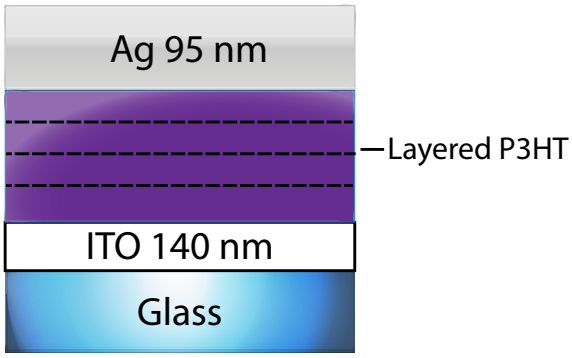

Figure S4: Device architecture for two-point conductivity test

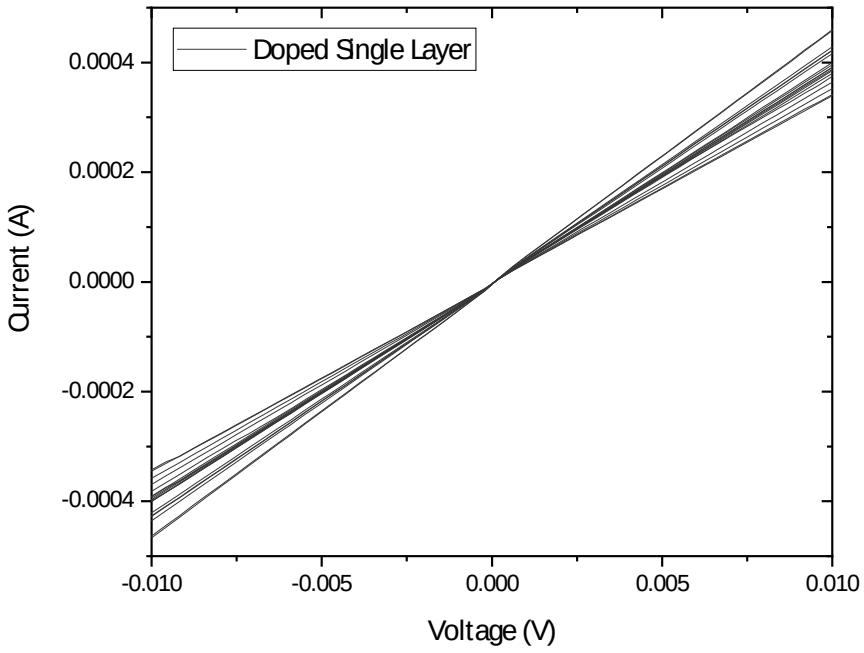

Figure S5: IV Data of doped single layer P3HT film from several substrates, 6 electrodes per substrate. Omitted data from electrodes where good electrical connection could not be obtained.

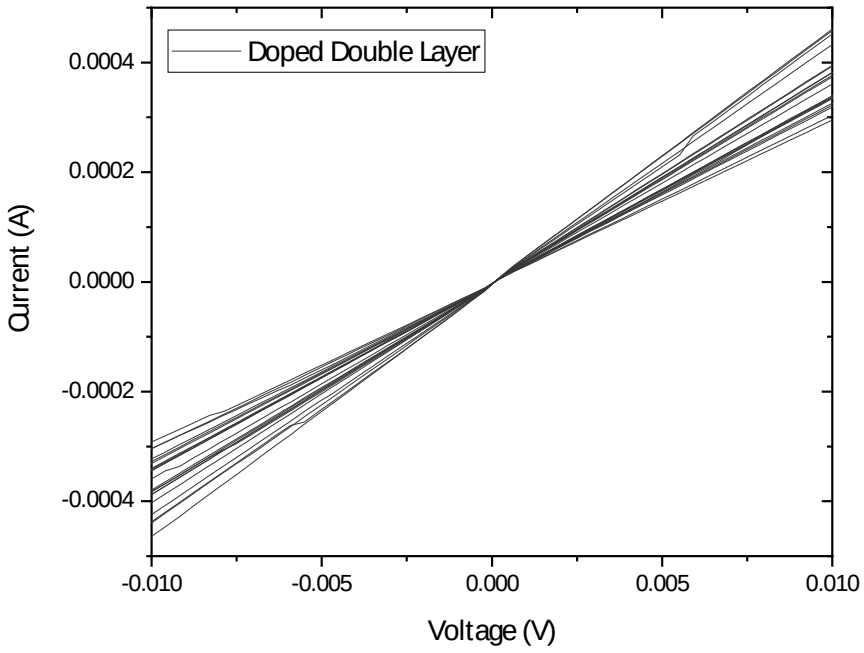

Figure S6: IV Data of doped double layer P3HT film from several substrates, 6 electrodes per substrate. Omitted data from electrodes where good electrical connection could not be obtained.

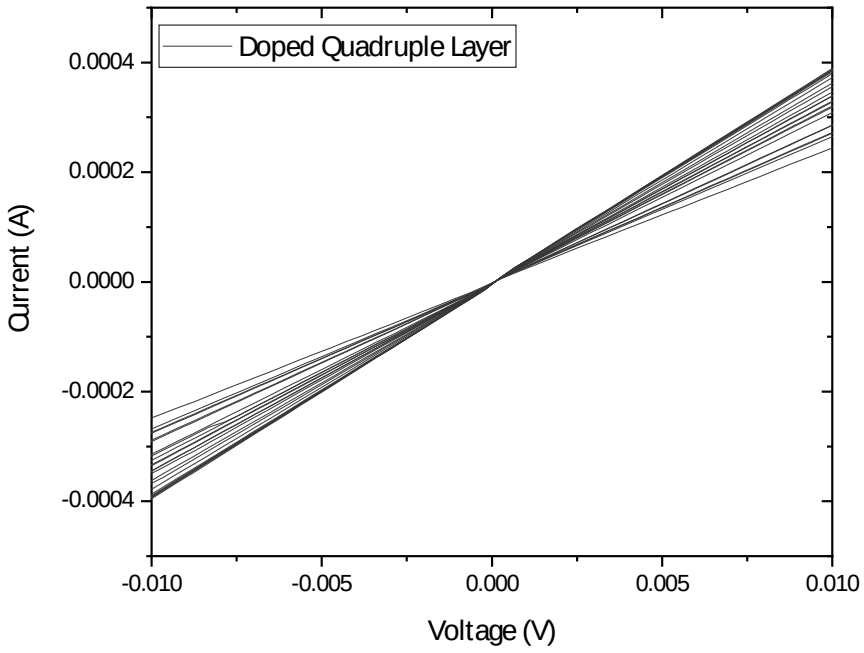

Figure S7: IV Data of doped quadruple layer P3HT film from several substrates, 6 electrodes per substrate. Omitted data from electrodes where good electrical connection could not be obtained.

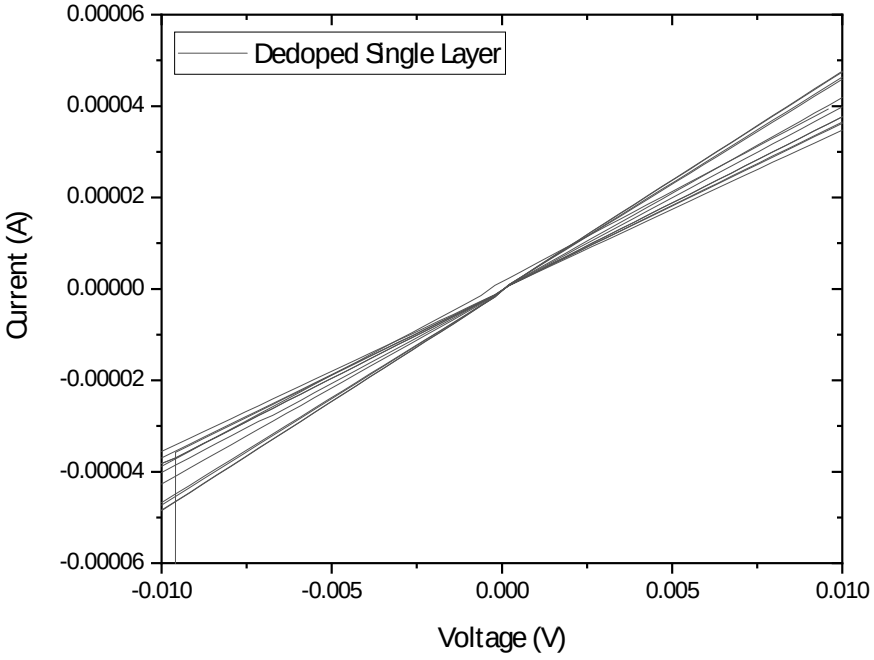

Figure S8: IV Data of dedoped single layer P3HT film from several substrates, 6 electrodes per substrate. Omitted data from electrodes where good electrical connection could not be obtained.

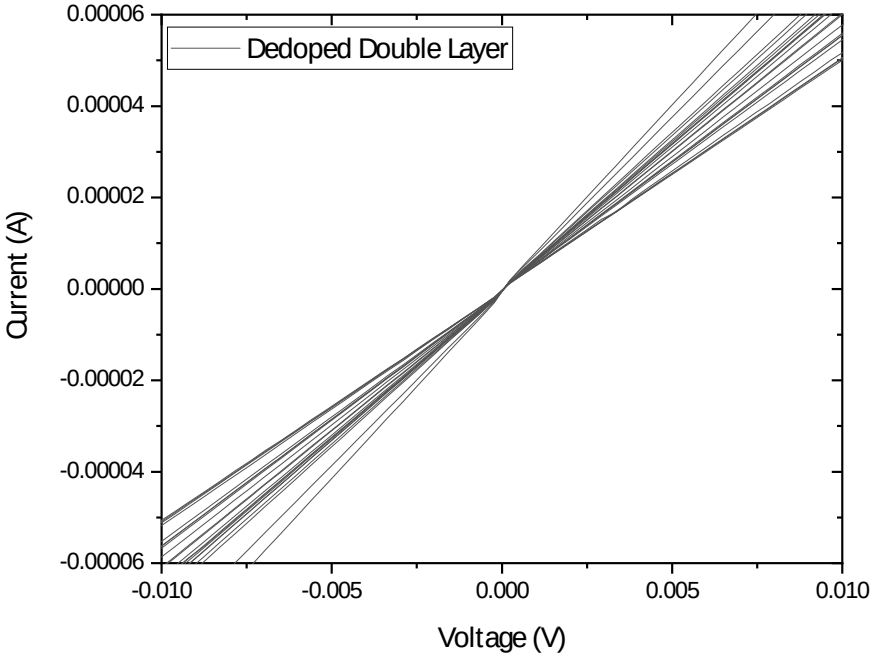

Figure S9: IV Data of dedoped double layer P3HT film from several substrates, 6 electrodes per substrate. Omitted data from electrodes where good electrical connection could not be obtained.

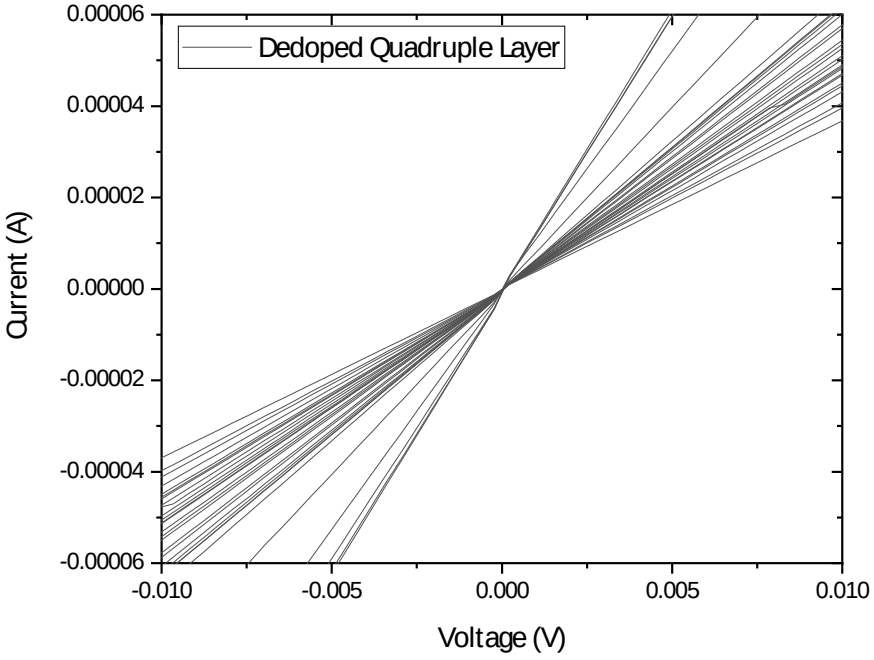

Figure S10: IV Data of dedoped quadruple layer P3HT film from several substrates, 6 electrodes per substrate. Omitted data from electrodes where good electrical connection could not be obtained.