Electronic Supplementary Material (ESI) for Nanoscale.
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Electronic Supporting Information

Enhancing Catalytic Activity of Polyethylenedioxythiophene towards Tri-iodide Reduction in DSSC *via* 1-Dimensional Alignment Using Hollow Carbon Nanofiber

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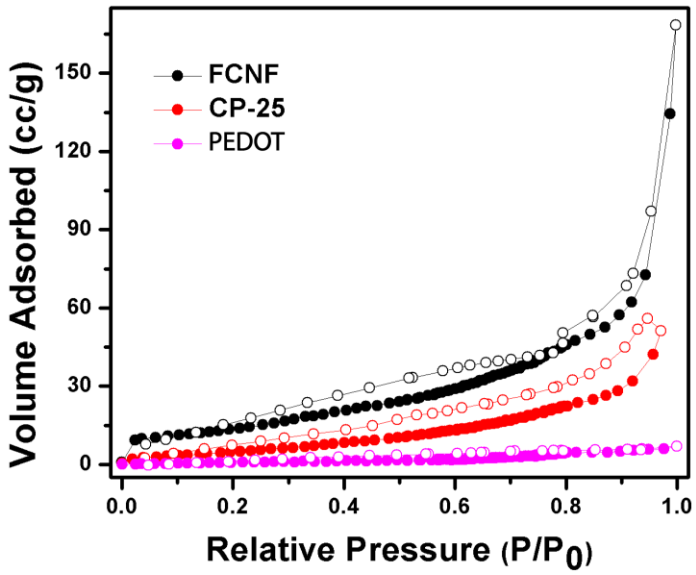

Figure S1. Nitrogen adsorption isotherm of CNF, PEDOT and CP-25

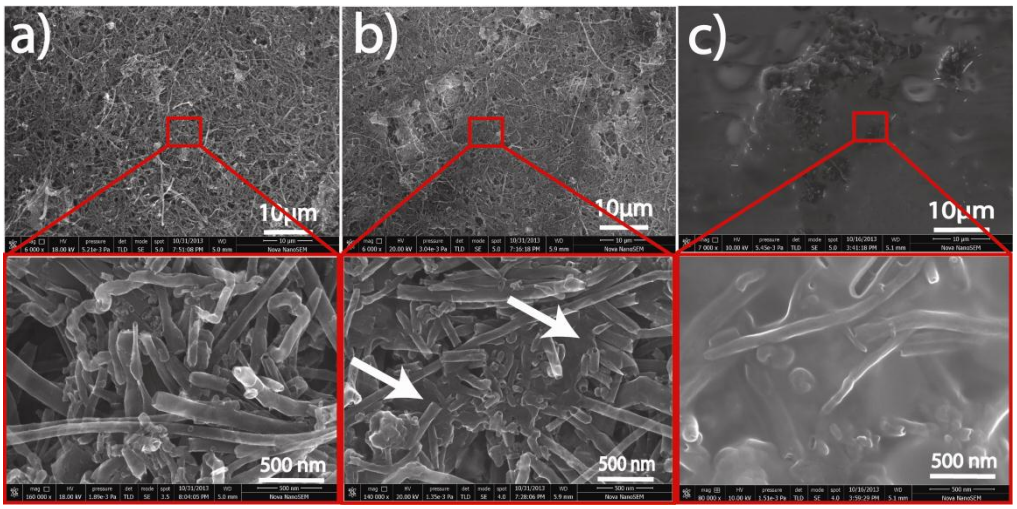

Figure S2: F-SEM images of a) CP-10, b) CP-40 and c) CP-60

Table S1: Four-probe electrical conductivity data of the prepared samples.

	Conductivity Scm^{-1}
CP-10	10.0

CP-25	35.1
CP-40	26.3
CP-60	8.0
PEDOT	1.5
CNF	2.2

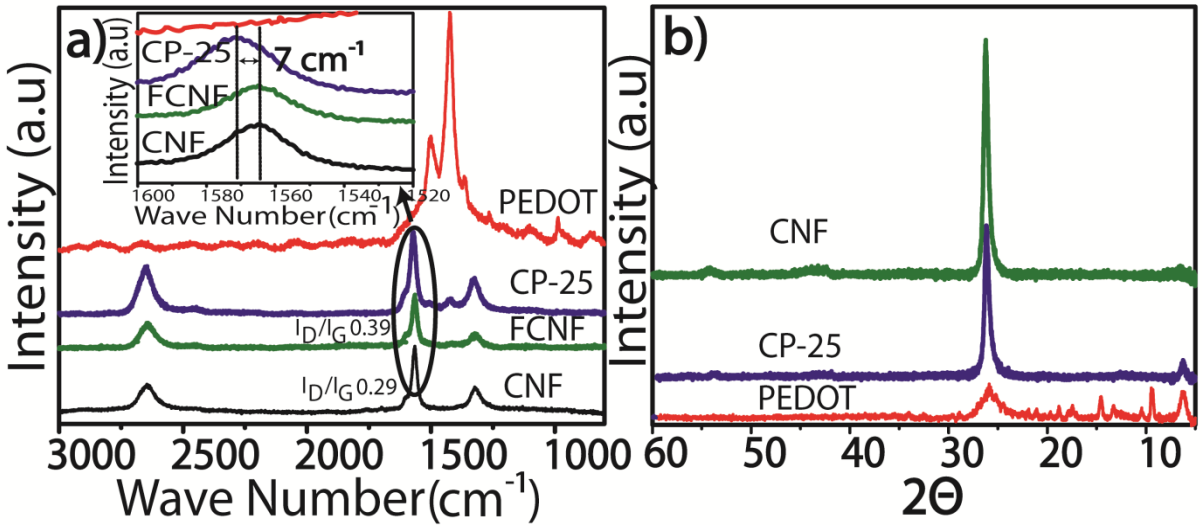

Figure S3: a) Raman spectra of the samples with enlarged portion of the G band in the inset and b) XRD spectra of CNF, PEDOT and CP-25.

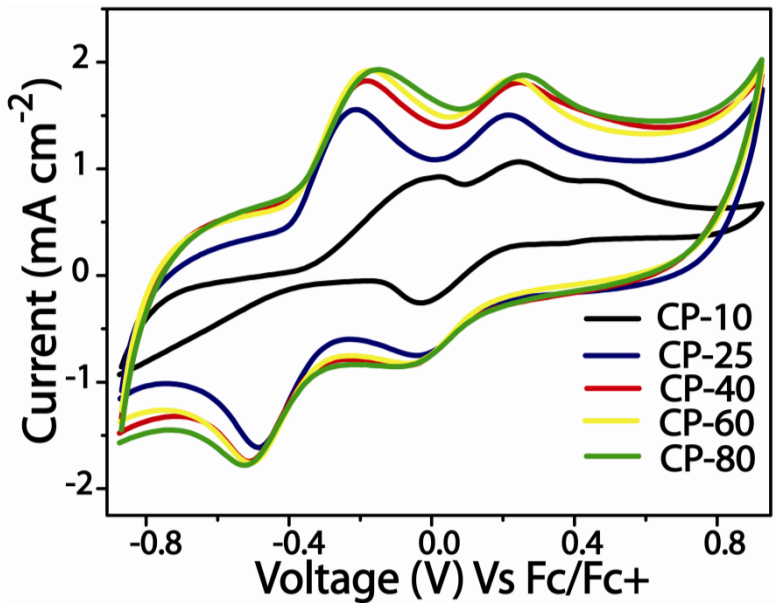

Figure S4: Cyclic voltamograms of the CP samples with different PEDOT loadings taken at a scan rate of 50 mV s^{-1}.

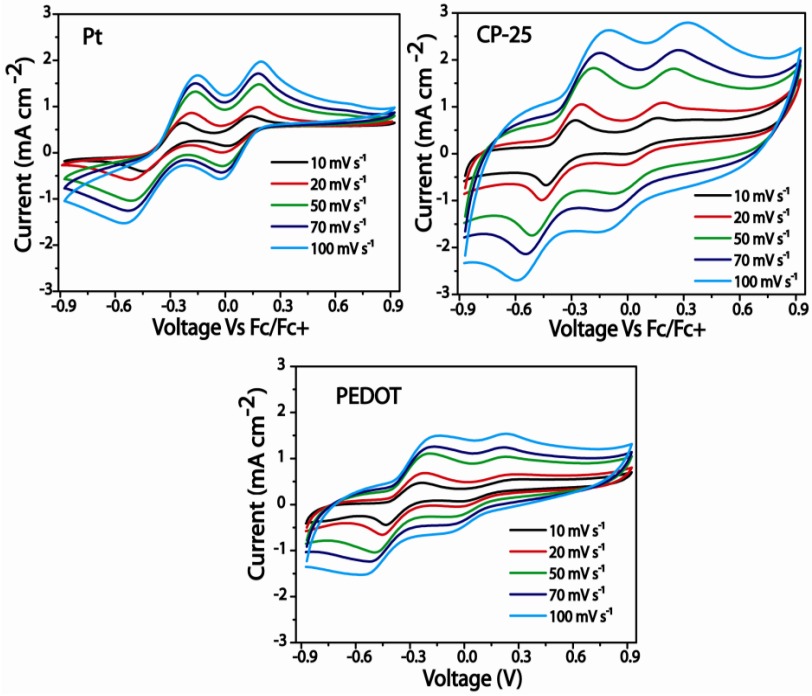

Figure S5: Cyclic voltamograms of Pt, CP and PEDOT taken at different scan rates.

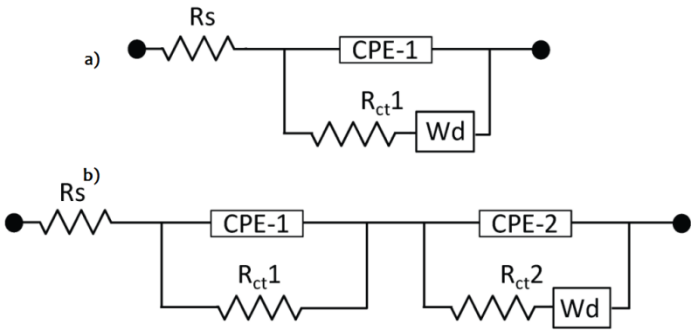

Figure S6:Circuit diagresm used for fitting the EIS data a) Pt and b) PEDOT , CP-25 and CNF.

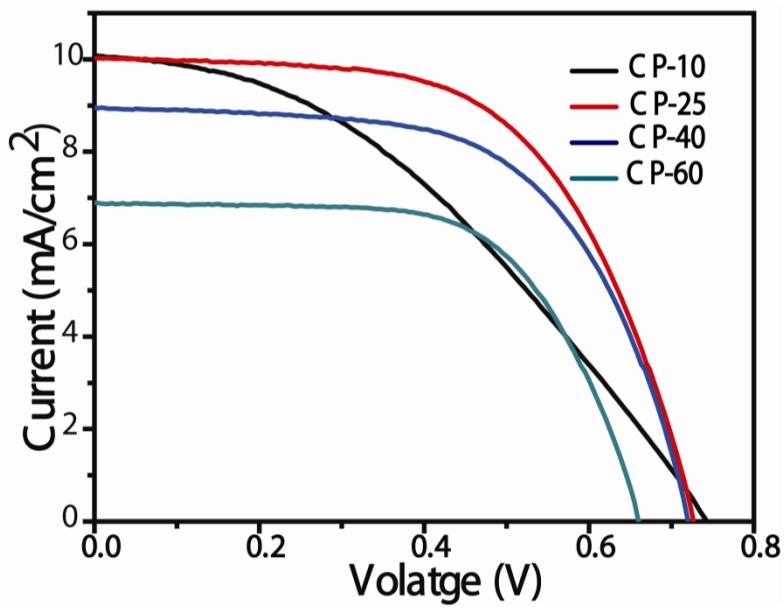

Figure S7: I-V data of the composites.

Only two layer TiO_2 films (total thickness 6 micron) were used to evaluate the optimum composition of the counter electrode. Table S2 gives the corresponding photovoltaic parameters.

Table S2: Values extracted from the photovoltaic performance profiles of the composites with different amount of PEDOT.

	V_{oc} (V)	J_{sc} (mA cm^{-2})	Fill Factor (%)	Efficiency (%)
CP-10	0.743	10.01	39.35	3.10
CP-25	0.726	10.00	60.10	4.56
CP-40	0.719	8.933	60.43	4.11
CP-60	0.660	6.873	63.78	3.06

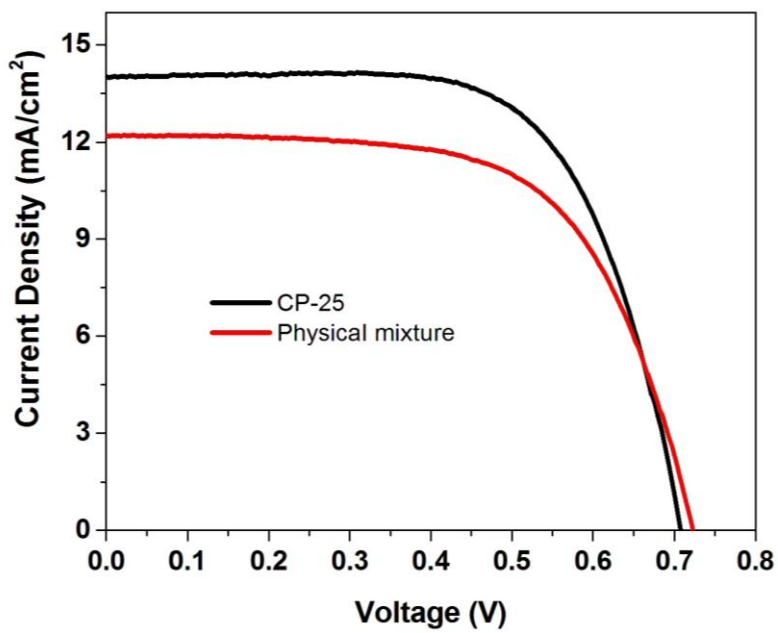

Figure S8: I-V data of CP-25 and physical mixture

Table S3: Values extracted from the photovoltaic performance profiles of CP-25 and the physical mixture.

	V_{oc} (V)	J_{sc} (mA cm^{-2})	Fill Factor (%)	Efficiency (%)
CP-25	0.70	14.0	66.5	6.59

Physical-mixture	0.72	12.2	63.3	5.58

Both CP-25 and the physical mixture contain 25 % of PEDOT. However, the difference in the conversion efficiency is clearly due to the peculiar 1-D alignment of PEDOT in CP-25 which helps to increase the surface area, conductivity and to attain low charge transfer resistance. In the case of CP-25, due to the reduced rate of polymerization rate, a film of PEDOT is formed along the inner and outer surfaces of the hollow carbon fiber. On the other hand, in the case of the physical mixture, the system will show an average characteristic of the bulk CNF and PEDOT and result in low fill factor and Jsc compared to the bulk PEDOT likely due to the exposed surfaces of CNF in the electrolyte. In CP-25, the exposed surface is only PEDOT, which has higher surface area, and electrical conductivity resulting in high photo-conversion efficiency.