Supplementary information for

Improved Efficiency of Solution-Processed Bulk-Heterojunction Organic Solar Cells and Planar-Heterojunction Perovskite Solar with Efficient Hole-Extracting Si Nanocrystals

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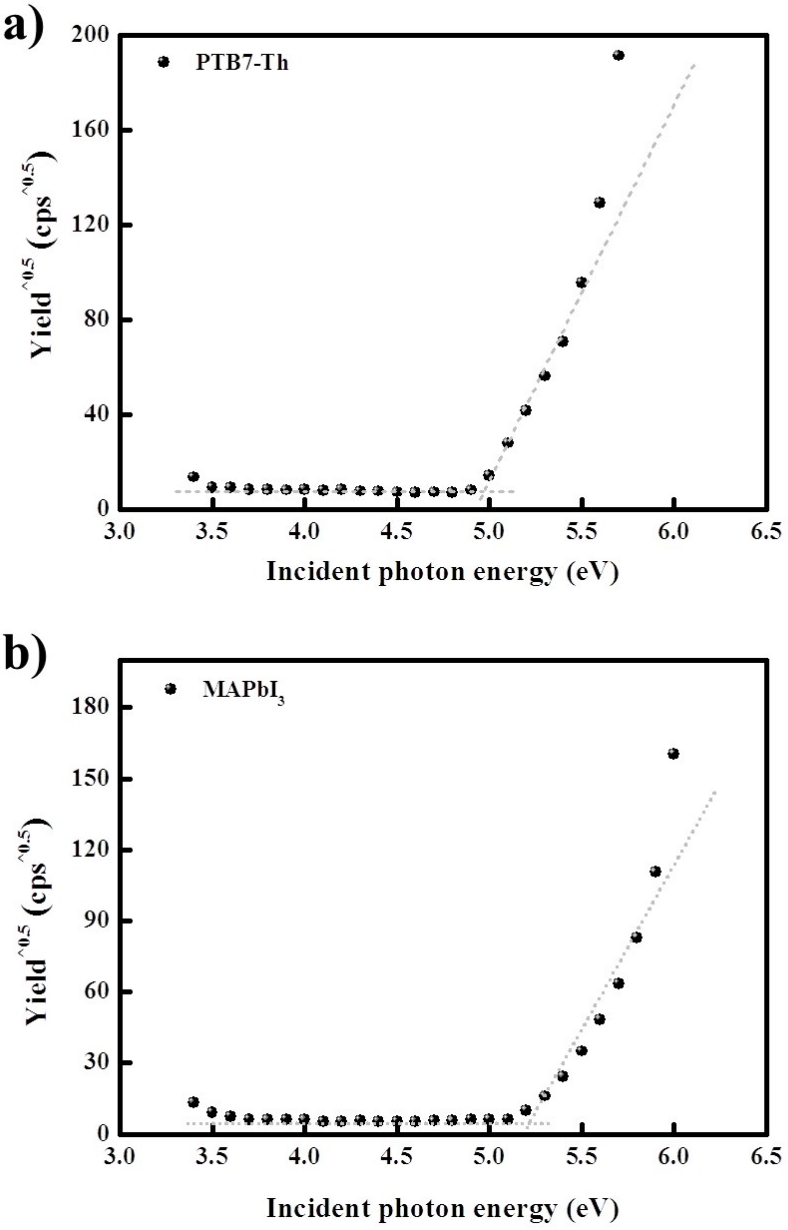

Figure S1. The UPS spectra of (a) PTB7-Th and (b) $MAPbI_3$ materials, which were estimated from the ionization potentials.

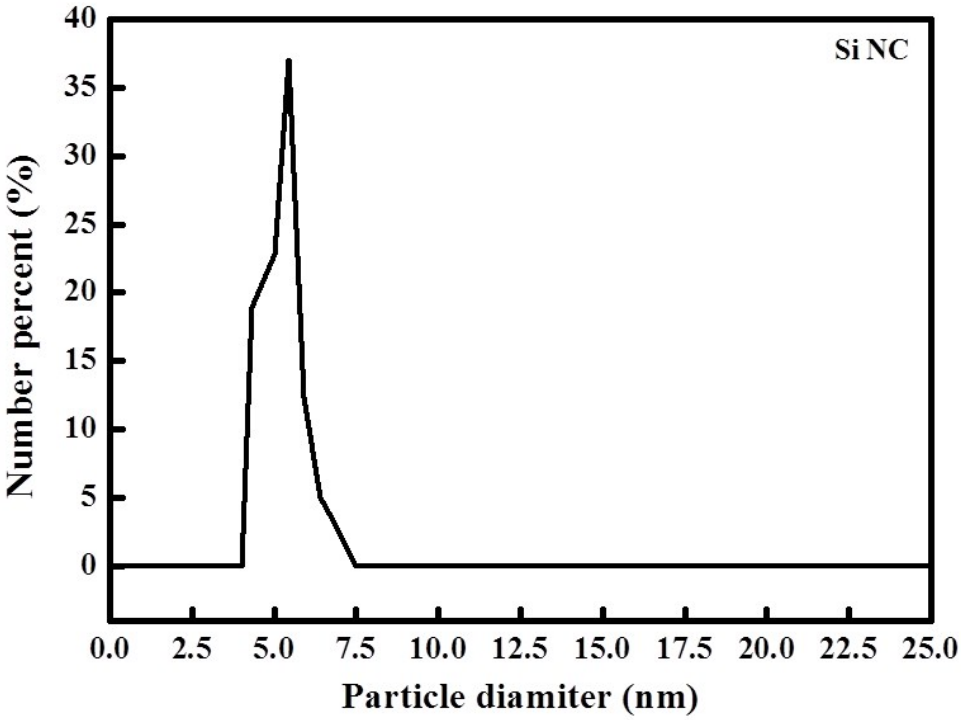

Figure S2. DLS spectra of Si NCs prepared using a modified electrochemical etching method.

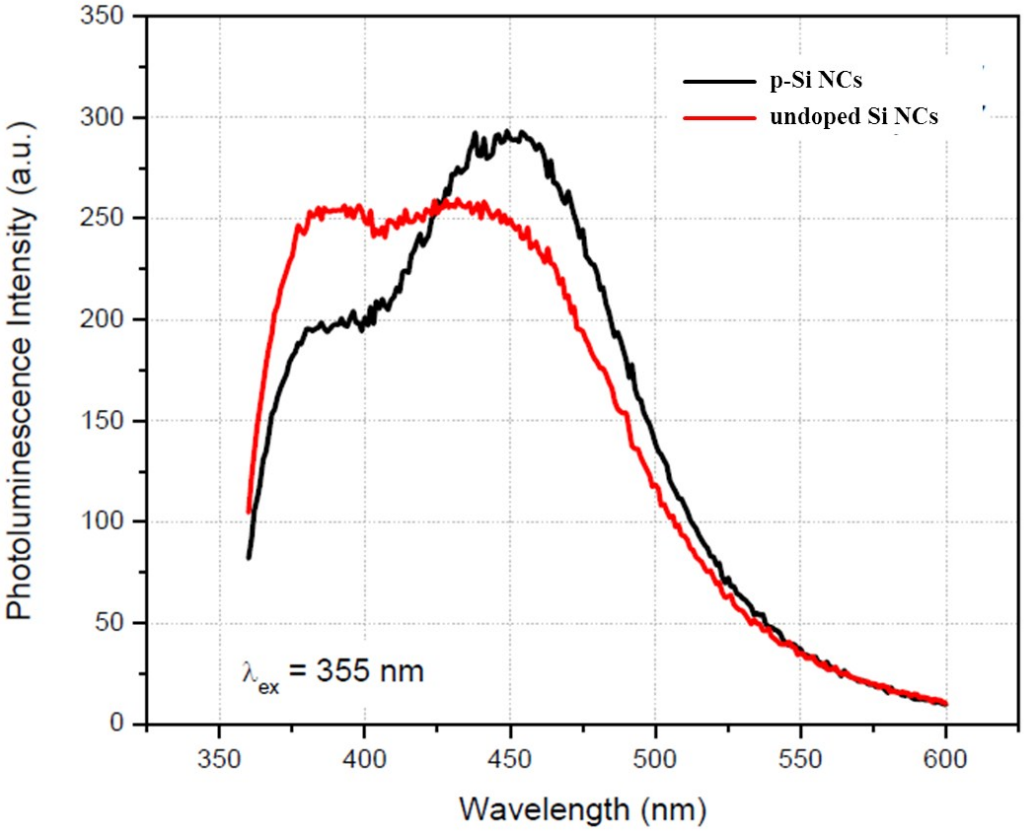

Figure S3. Photoluminescence spectra of p-Si NCs and undoped Si NCs, which were obtained from B-doped and undoped polycrystalline silicon wafers, respectively, by a modified electrochemical etching approach.

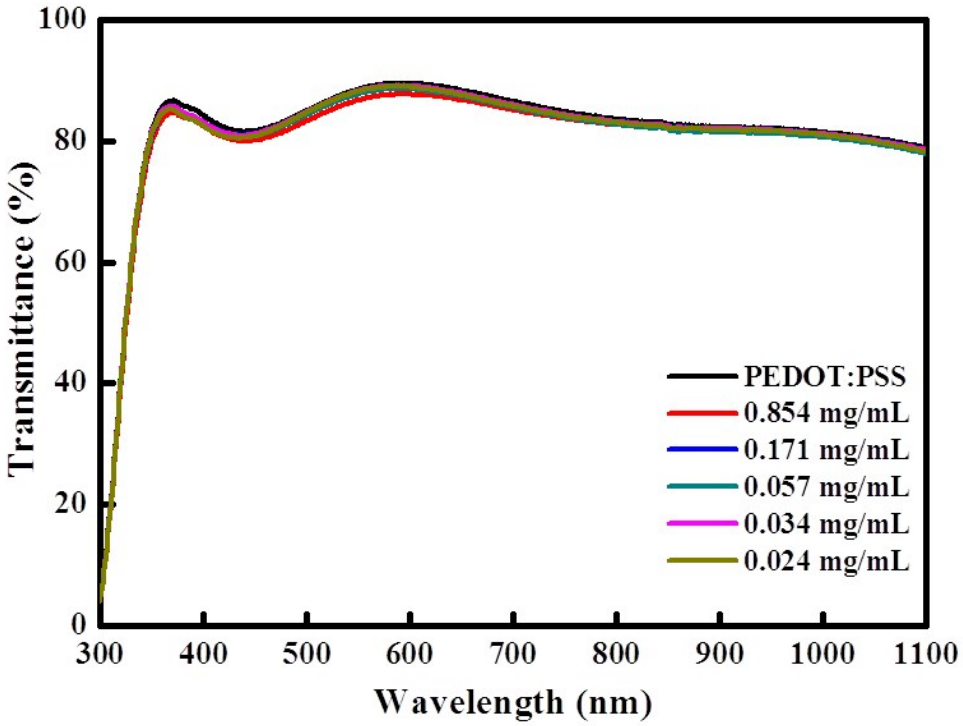

Figure S4. Transmittance spectra of Si NCs spin-cast on the ITO/PEDOT:PSS substrates for various Si NCs concentrations (0.024, 0.034, 0.057, 0.171, and 0.854 mg/ml) in CB.

Table S1. Photovoltaic performances of these BHJ OSC (black) and PHJ PrSC (red) devices with PEDOT:PSS/p-Si NC HEM layers fabricated at various concentrations (0, 0.024, 0.034, 0.057, 0.171, and 0.854 mg/ml) of Si NCs in CB solvent.[a]

Devices	p-Si NC (mg/mL)	$J_{sc\ ave/max}$ (mA/cm^2)	$V_{oc\ ave/max}$ (V)	$F{\cdot}F_{ave/max}$	$\eta_{ave/max}$ (%)
PTB7-Th:$PC_{71}BM$ BHJ OSC	0	16.46/16.62	0.81/0.82	0.61/0.62	8.21/8.35
	0.024	16.89/17.16	0.79/0.80	0.65/0.66	8.21/8.95
	0.034	17.16/17.78	0.79/0.80	0.64/0.66	8.70/9.25
	0.057	16.90/17.21	0.80/0.80	0.64/0.66	8.65/8.96
	0.171	16.34/17.04	0.79/0.80	0.63/0.66	8.14/8.54
	0.854	14.20/15.72	0.78/0.80	0.63/0.66	7.00/7.92
$MAPbI_3/PC_{61}BM$ PHJ PrSC	0	15.23/15.69	0.73/0.74	0.76/0.77	8.47/8.59
	0.024	17.96/18.29	0.74/0.74	0.77/0.78	10.25/10.53
	0.034	18.00/18.22	0.74/0.75	0.77/0.78	10.33/10.52
	0.057	17.62/18.29	0.75/0.77	0.76/0.77	8.76/9.04
	0.171	16.24/16.92	0.70/0.72	0.75/0.77	8.49/9.16
	0.854	16.27/16.86	0.51/0.57	0.63/0.70	5.27/6.61

[a)] The performances are determined under simulated 100 mW·cm^{-2} AM 1.5 illumination. The light intensity using calibrated standard silicon solar cells with a proactive window made from KG5 filter glass traced to the NREL. The active area of device is 4.5 mm^2.