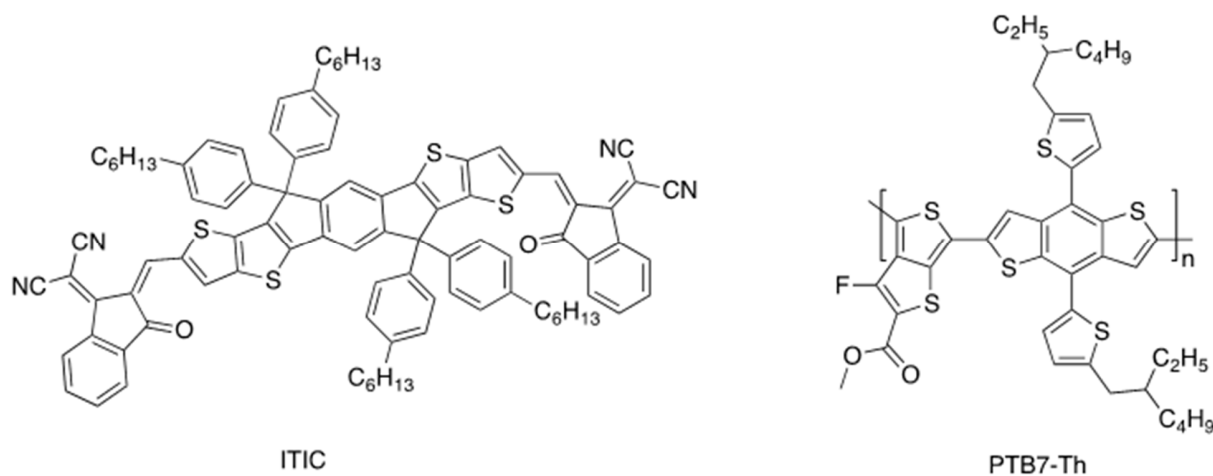
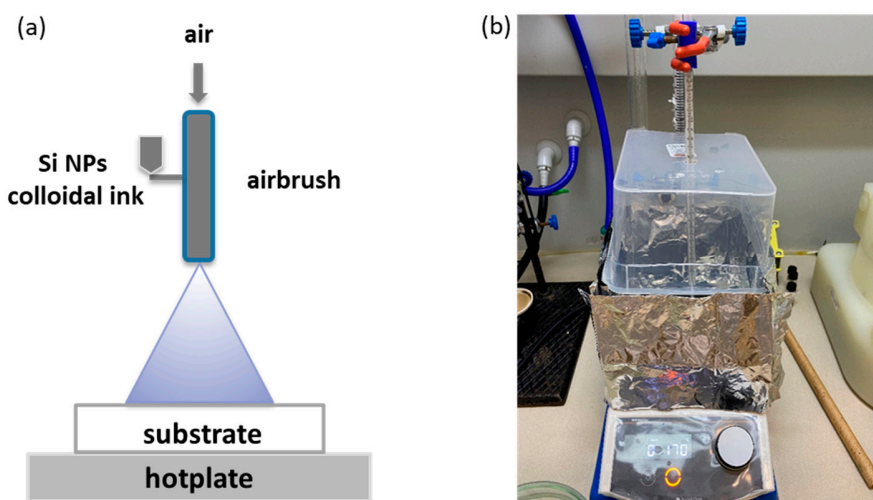


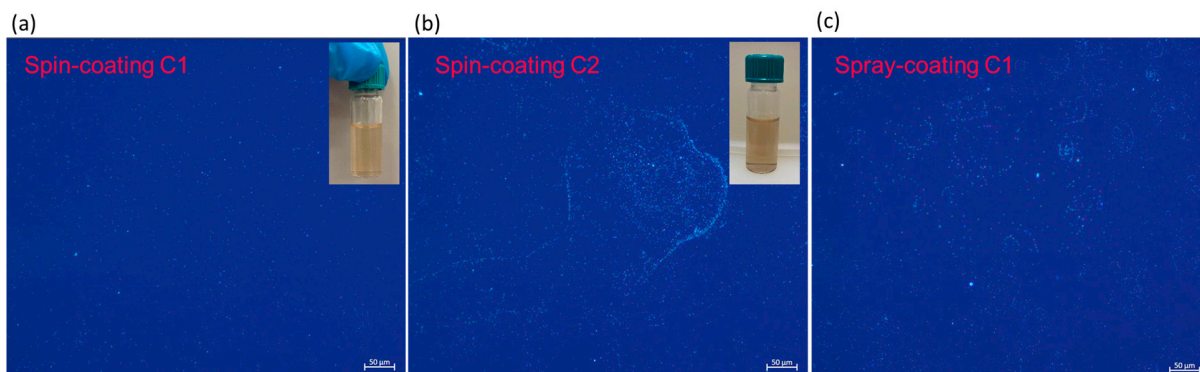
## Supplementary Materials



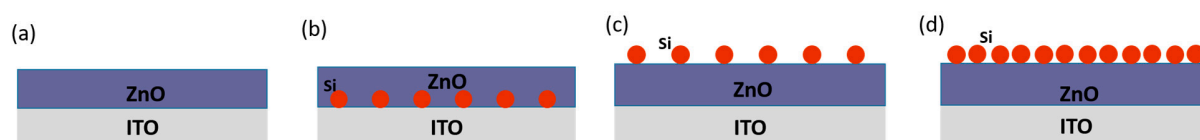
**Figure S1.** Chemical of nonfullerene acceptor ITIC (3,9-bis(2-methylene-(3-(1,1-dicyanomethylene)-indanone)-5,5,11,11-tetrakis(4-hexylphenyl)-dithieno[2,3-d':2',3'-d']-s-indaceno[1,2-b:5,6-b']-dithiophene) and repeat unit structures of donor polymer molecules PTB7-Th (PBDTTT-EFT, Poly-[4,8-bis-(5-(2-ethylhexyl)-thiophen-2-yl)benzo-[1,2-b;4,5-b']-dithiophene-2,6-diyl-alt-(4-(2-ethylhexyl)-3-fluorothieno-[3,4-b]thiophene)-2-carboxylate-2,6-diyl)]) used in the study.



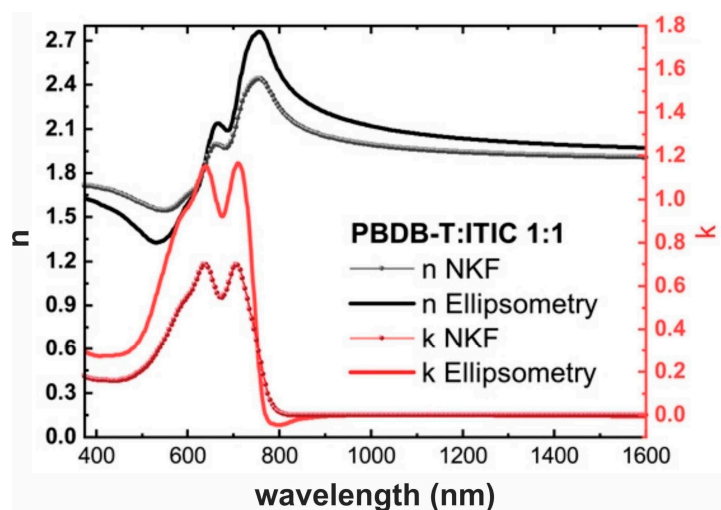
**Figure S2.** A schematic diagram of the spray coating technique (a) and photo of the setup (b).



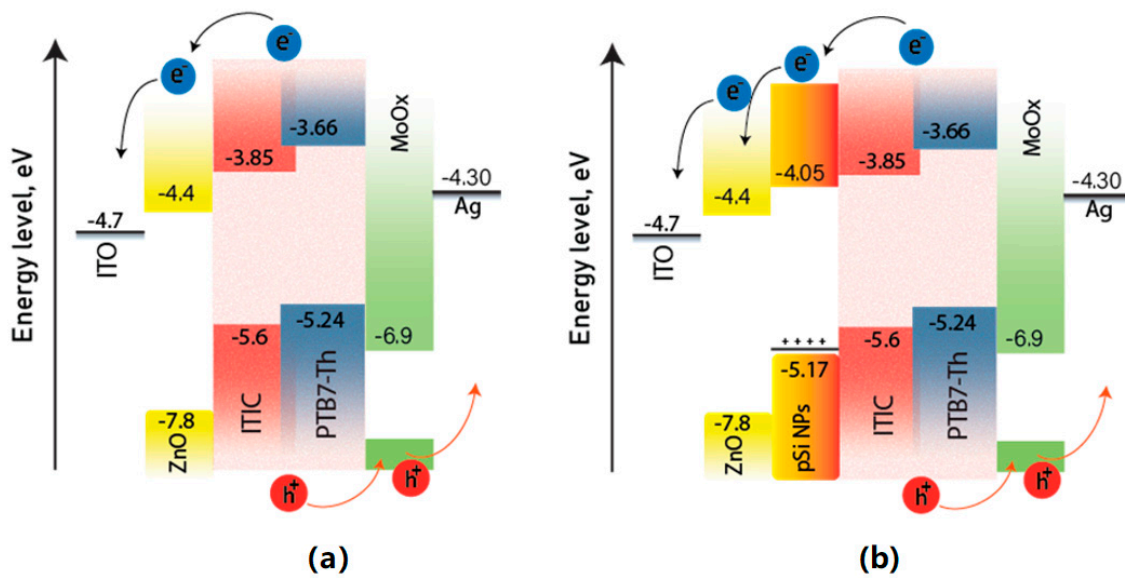
**Figure S3.** Optical images in the dark-field scheme of silicon nanoparticles deposited on ZnO interlayer by spin-coating and spray-coating techniques: (a) spin-coating of diluted colloidal Si NPs ink (C1); (b) spin-coating of ink with higher concentration of Si NPs (C2); (c) spray-coating of ink with concentration C1.



**Figure S4.** Schematic drawings of OPV devices without dielectric nanoparticles (a) and with dielectric Si nanoparticles incorporated in the buffer layer ZnO (b), c) Si NPs deposited ZnO/ITO substrates (ZnO/Si) with fewer concentrations (C1), and d) Si NPs deposited on ZnO/ITO substrate with higher concentrations (C2).



**Figure S5.** Optical properties of PTB7-Th:ITIC. n - refractive index, k - extinction coefficient. Data is taken from Ref.[1].



**Figure S6.** (a) Energy band diagram of the device without and (b) with Si NPs.

**Table S1.** Comparison of Photovoltaic performance enhancement of OSCs devices with plasmonic Au NPs [2] and dielectric Si NPs (our work) for the same photoactive layer.

	$\Delta V_{oc}$ V	$\Delta I_{sc}$ mA/cm <sup>2</sup>	$\Delta FF$ %	$\Delta PCE$ relative %
ZnO:0.05 wt% Au NPs	-1.4%	+15%	+7%	+24%
Our work Si NPs with average size of 150 nm	+2%	+11%	+13%	+25%

**References:**

- [1] Kerremans, R.; Kaiser, C.; Li, W.; Zarrabi, N.; Meredith, P.; Armin, A. The Optical Constants of Solution-Processed Semiconductors—New Challenges with Perovskites and Non-Fullerene Acceptors. *Advanced Optical Materials* 2020, 8(16), 2000319
- [2] Usmani, B; Ranjan, R.; Prateek, Gupta, S. K.; Gupta, R.K.; Nalwa, K. S.; Garg, A.; Inverted PTB7-Th:PC71BM organic solar cells with 11.8% PCE via incorporation of gold nanoparticles in ZnO electron transport layer. *Solar Energy* 2021, 214, 220-230