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

Supporting Information:

Tetra-indole core as a dual agent: a hole selective layer that passivates defects in perovskite solar cells

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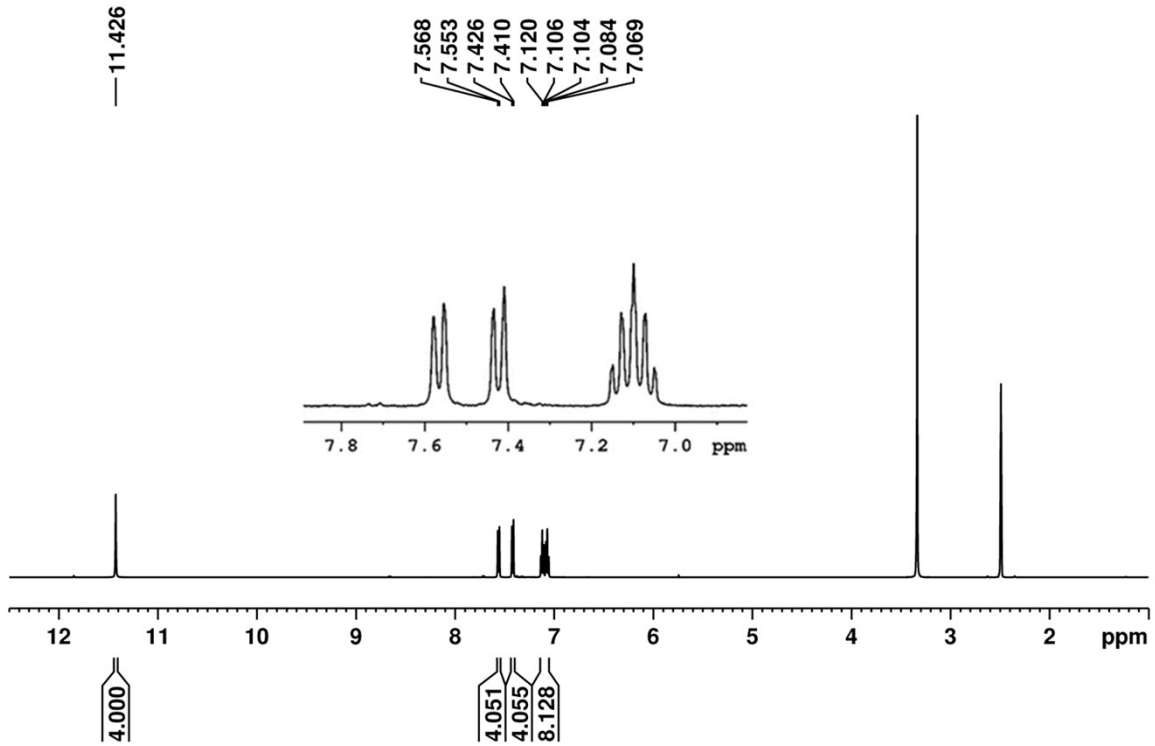

Figure S1: ^{1}H NMR of TTI in DMSO-d_6

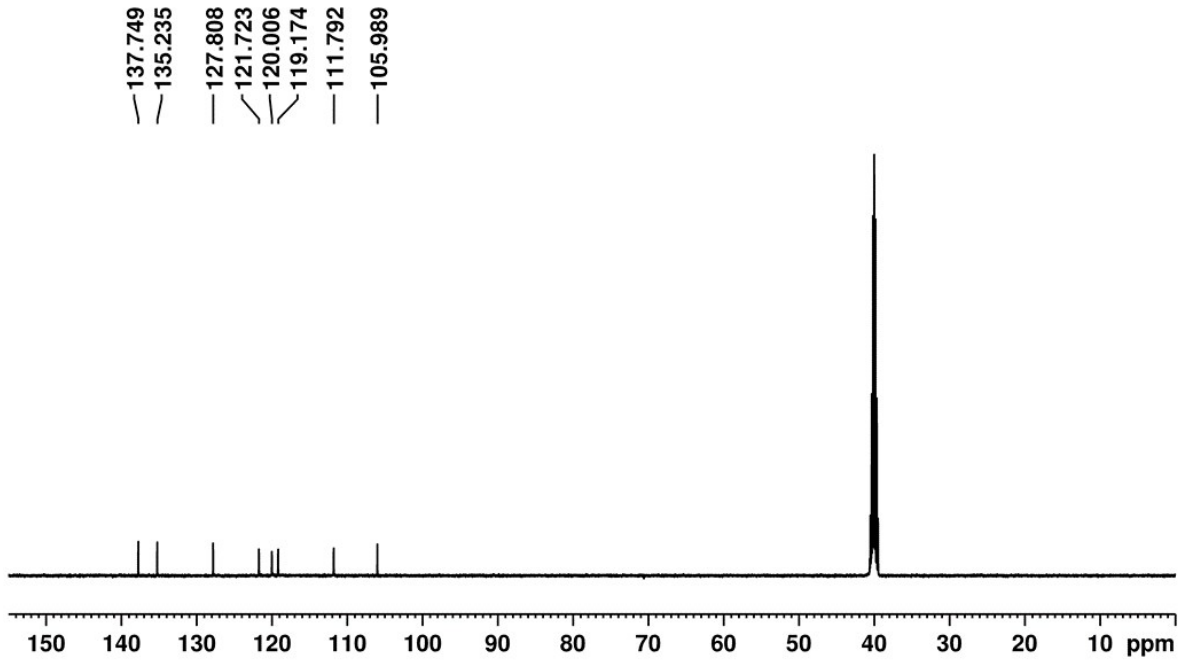

Figure S2: ^{13}C NMR of TTI in DMSO-d_6

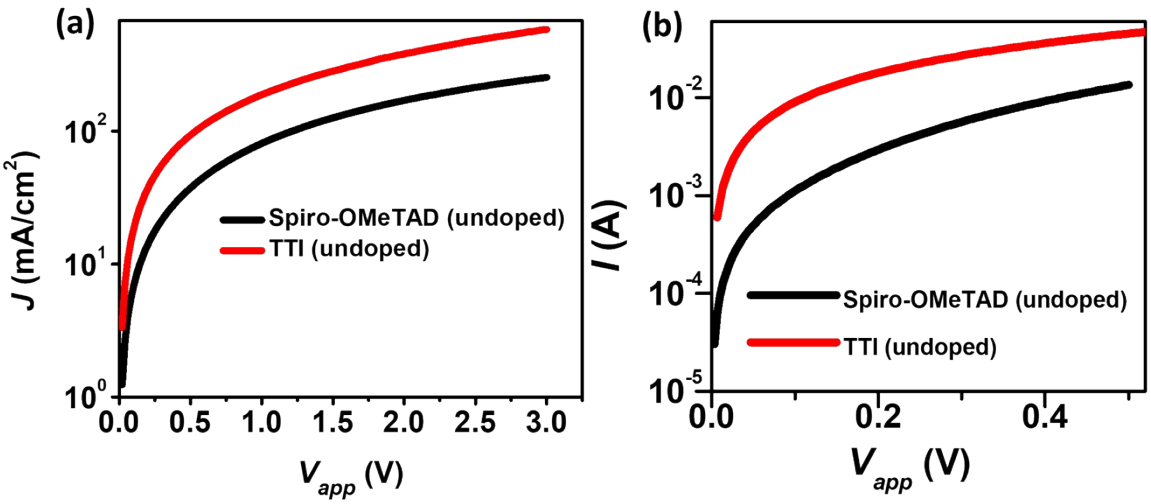

Figure S3: (a) Hole mobility measurements (device structure: FTO/PEDOT: PSS/HTM/Au) and (b) conductivity measurements (device structure: FTO/HTM/Au); of the undoped TTI and Spiro/OMeTAD.

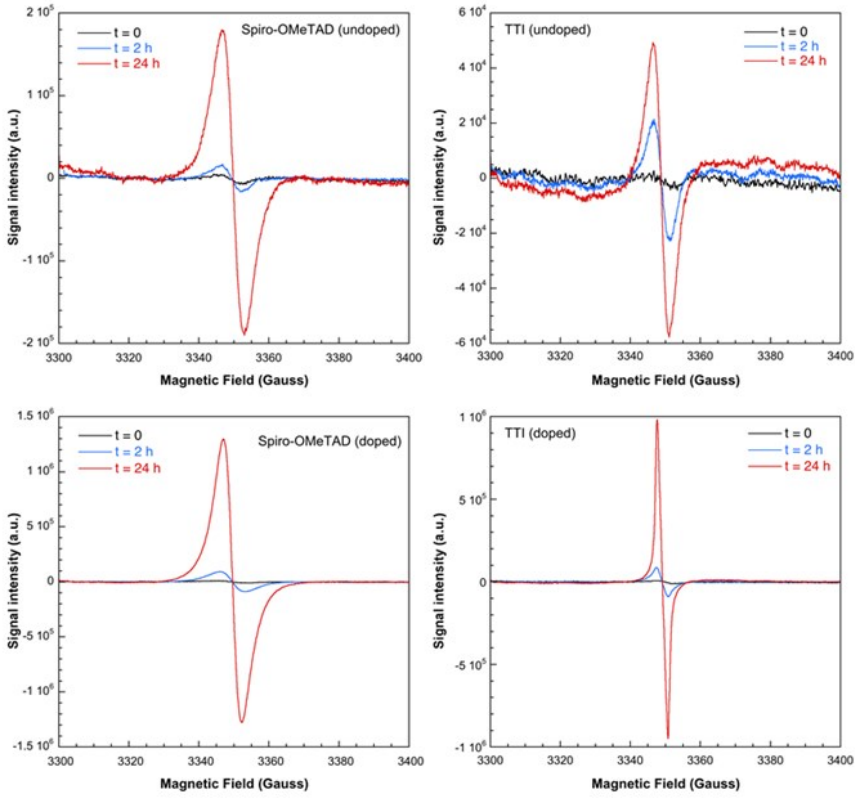

Figure S4. EPR spectra registered at room temperature in 30mM chlorobenzene solutions.

Table S1. EPR parameters for 30mM chlorobenzene solutions of doped and undoped spiro-OMeTAD and TTI.

HTM	g-factor	ΔBpp (Gauss)	Spin/mol	% Lorentz
Spiro-OMeTAD (undoped)	2.0034	6.1	9.8×10^{16}	50 %
Spiro-OMeTAD (doped)	2.0033	4.7	1.3×10^{18}	87 %
TTI (undoped)	2.0039	5.1	4.6×10^{16}	92 %
TTI (doped)	2.0037	0.55	3.5×10^{17}	100 %

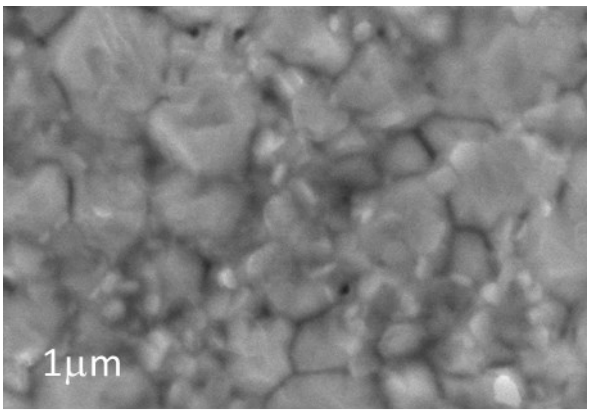

Figure S5: Surface SEM image of perovskite and TTI as the HTM layer.

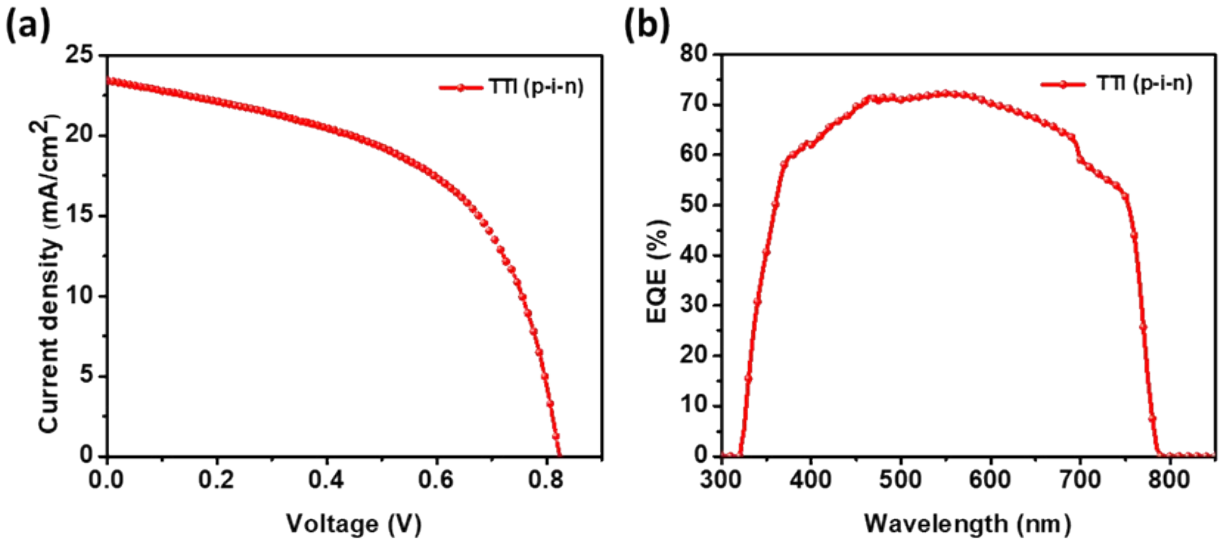

Figure S6: Current-voltage (*J-V*) characteristics of inverted structure PSCs based on TTI under Air-Mass (AM) 1.5G illumination and (b) corresponding EQE curve.

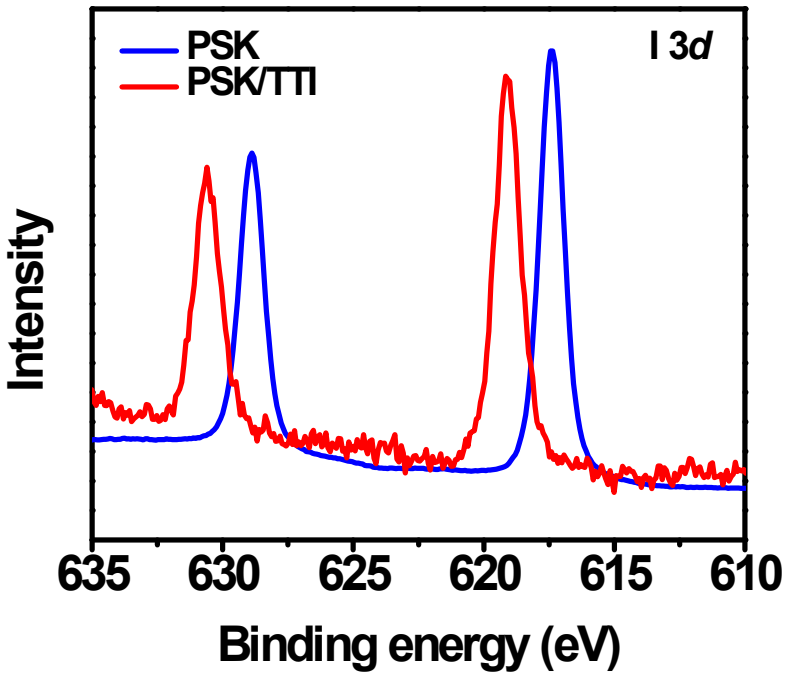

Figure S7: XPS spectra of I 3d peak of PSK/TTI film.

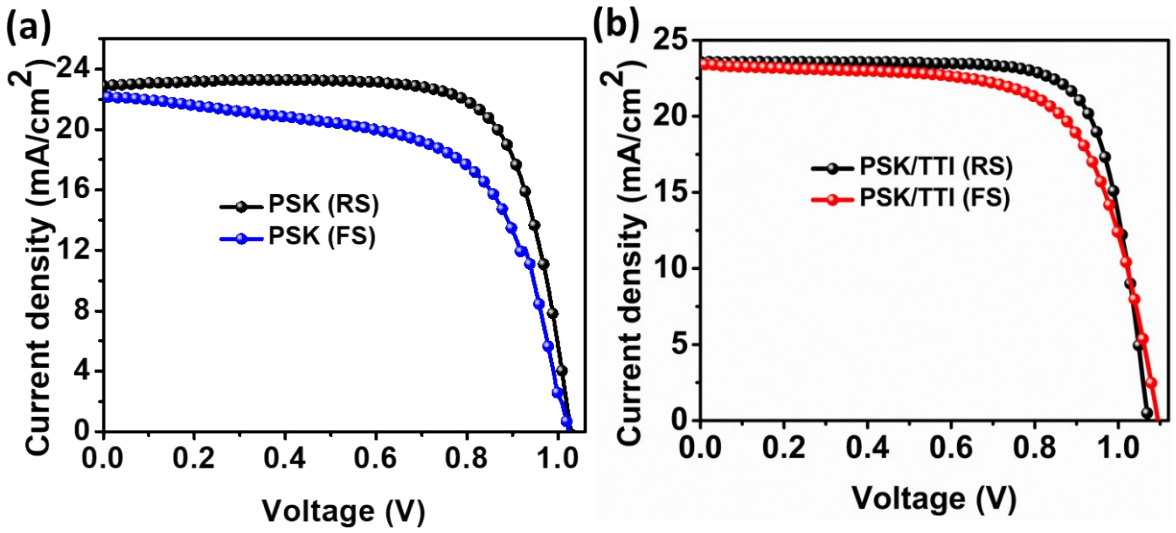

Figure S8: *J-V* characteristic of forward scan and reverse scan for (a) pristine {PSK} and (b) TTI passivated PSCs.

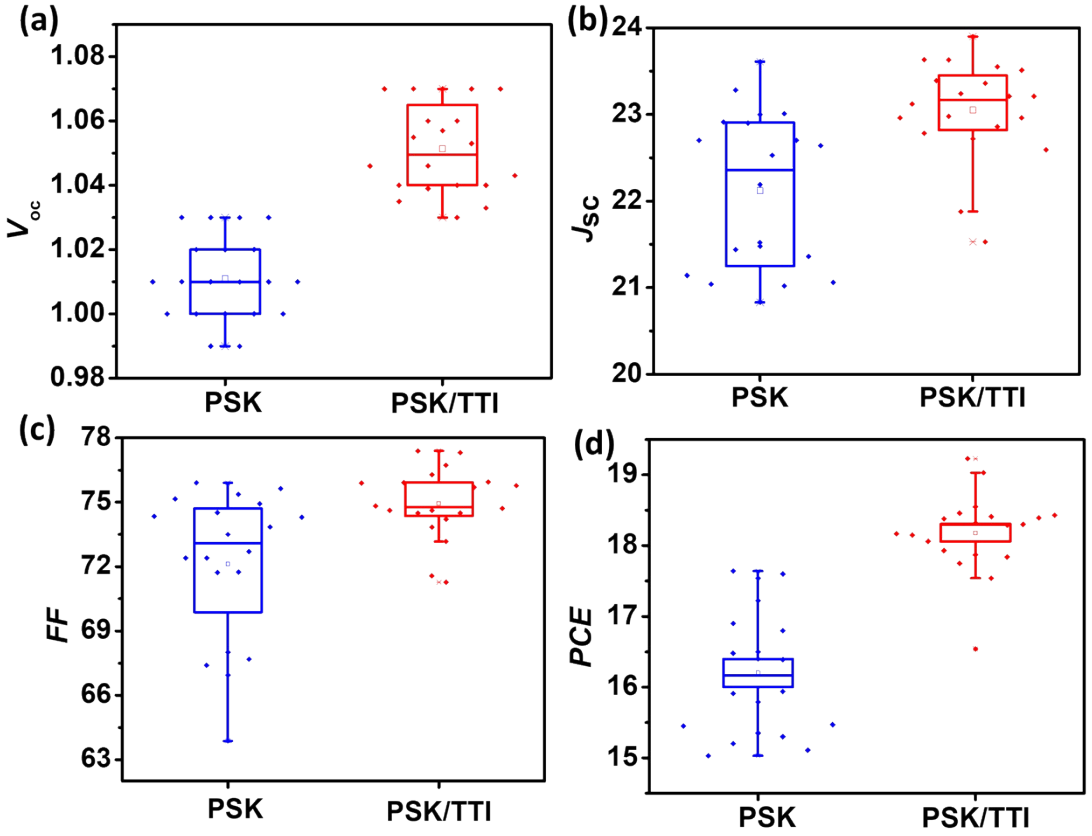

Figure S9: Device statistics (20 devices each) (a) V_{oc}, (b) $J_{SC,}$ (c) *FF and* (d) *PCE*, for pristine {PSK} and passivated (PSK/TTI) PSCs.

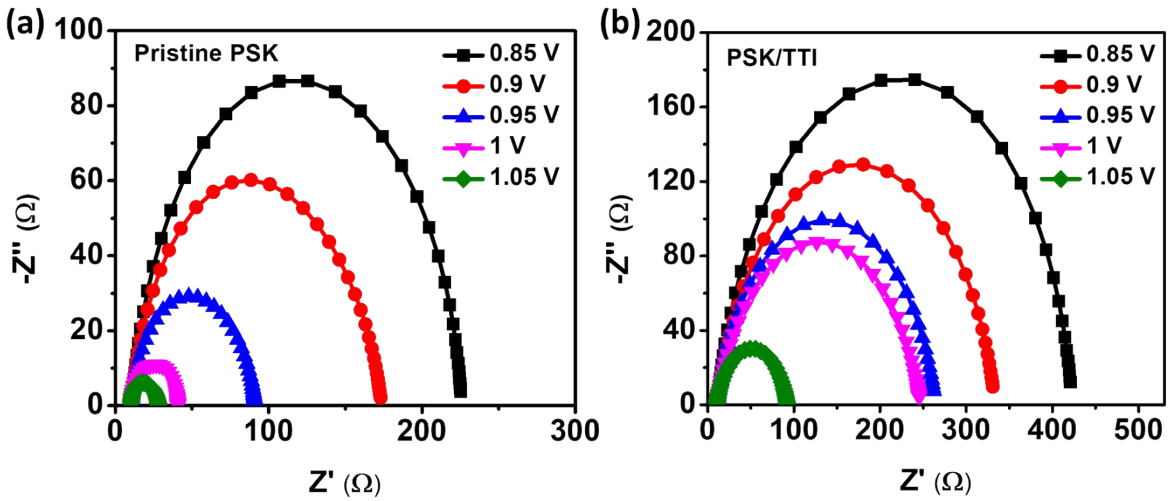

Figure S10: Nyquist plots for PSC, (a) pristine and (b) TTI passivated at variable voltages.

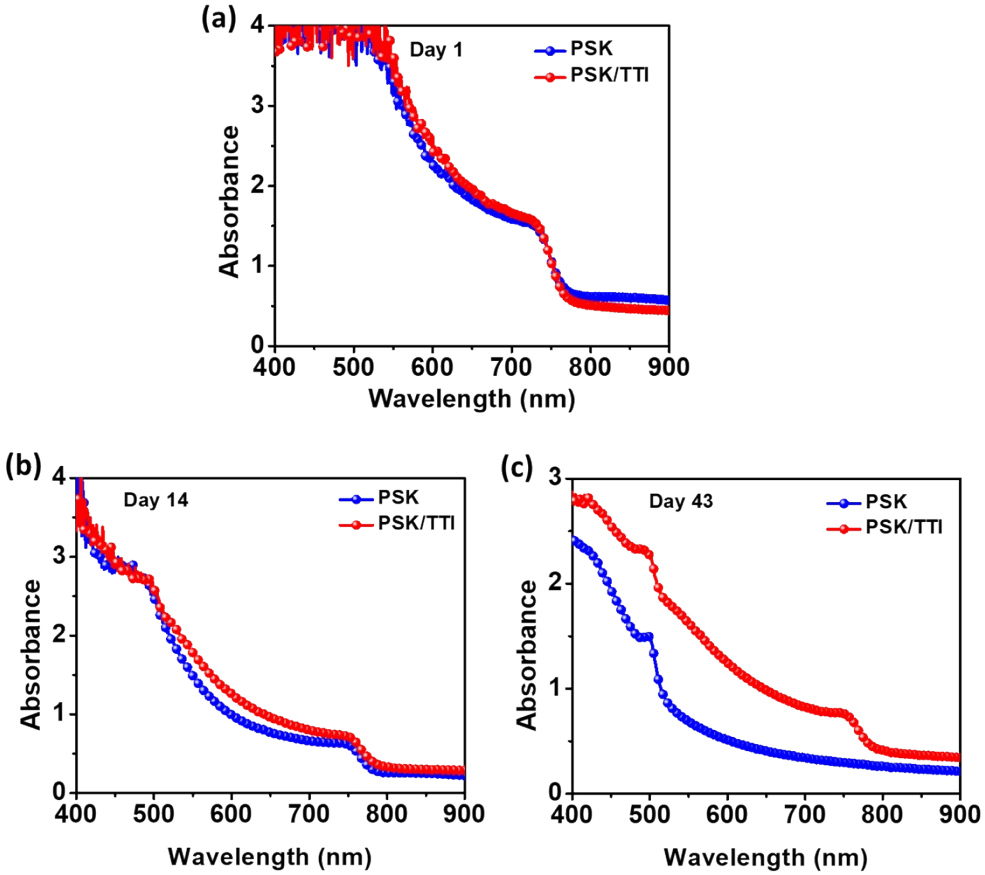

Figure S11: Absorption spectra of pristine perovskites (PSK) and PSK/TTI passivated perovskites under thermal annealing at 85°C (a) Day1 (b) Day 14 and (c) Day 43.