

Supplementary Information

Stabilization of nanoscale blend morphology in organic solar cells using solvent additives

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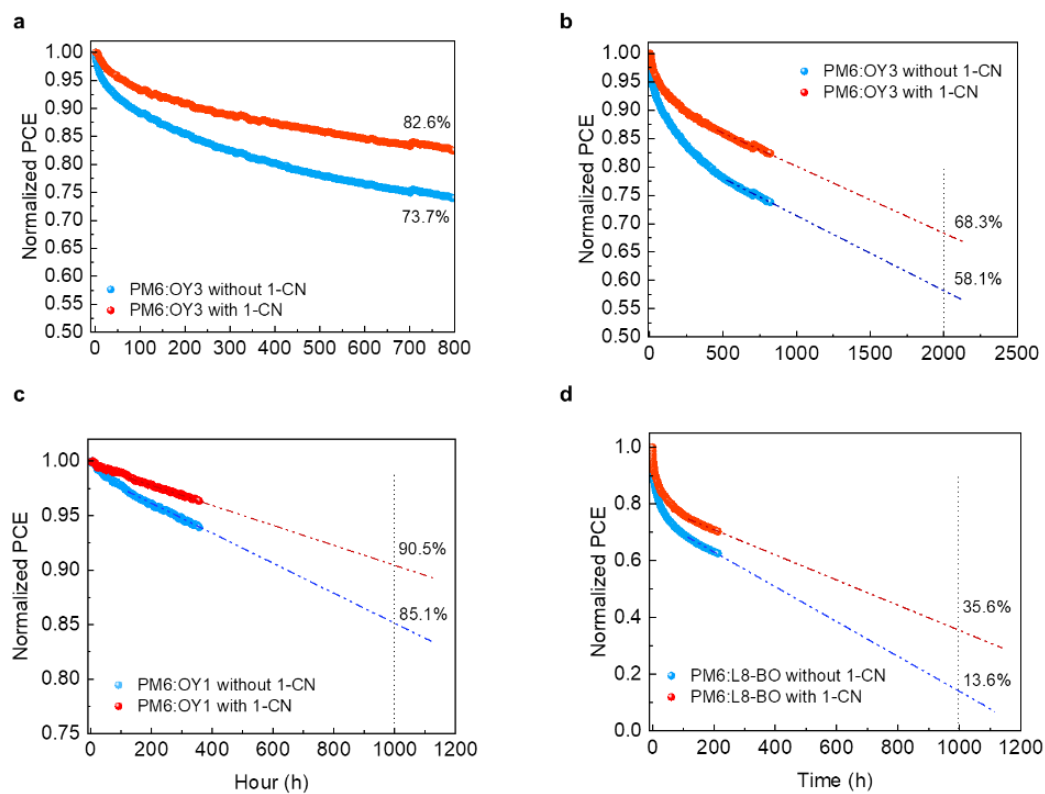


Fig. S1 (a) Stability tests conducted under 800h continuous 1-sun illumination for PM6:OY3 devices with and without 1-CN. (b) Stability test of PM6:OY3 with extrapolated efficiency degradation to 2000 h. (c, d) Stability test of PM6:OY1 (c) and PM6:L8-BO (d) with extrapolated efficiency degradation to 1000 h.

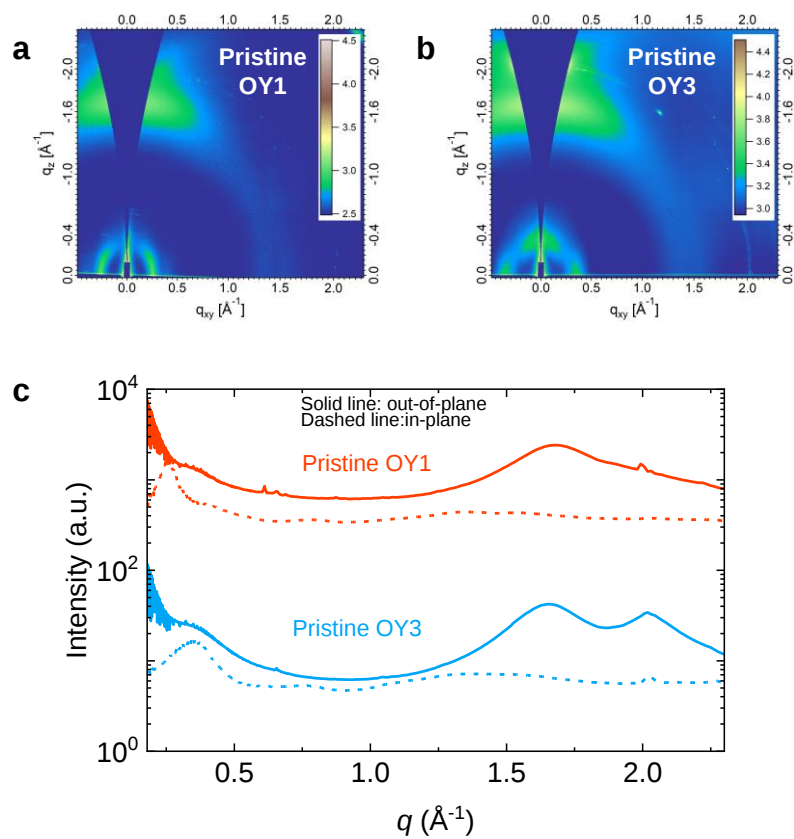


Fig. S2 GIWAXS measurement for pristine OY1 and OY3. **(a, b)** 2D GIWAXS patterns of pristine OY1 and OY3 respectively; **(c)** 1D line-cut profiles of pristine OY1 and OY3. This data illustrates that the peaks at $q_z \sim 1.7 \text{ \AA}^{-1}$ and $q_z \sim 2.0 \text{ \AA}^{-1}$ originated from acceptor phases.

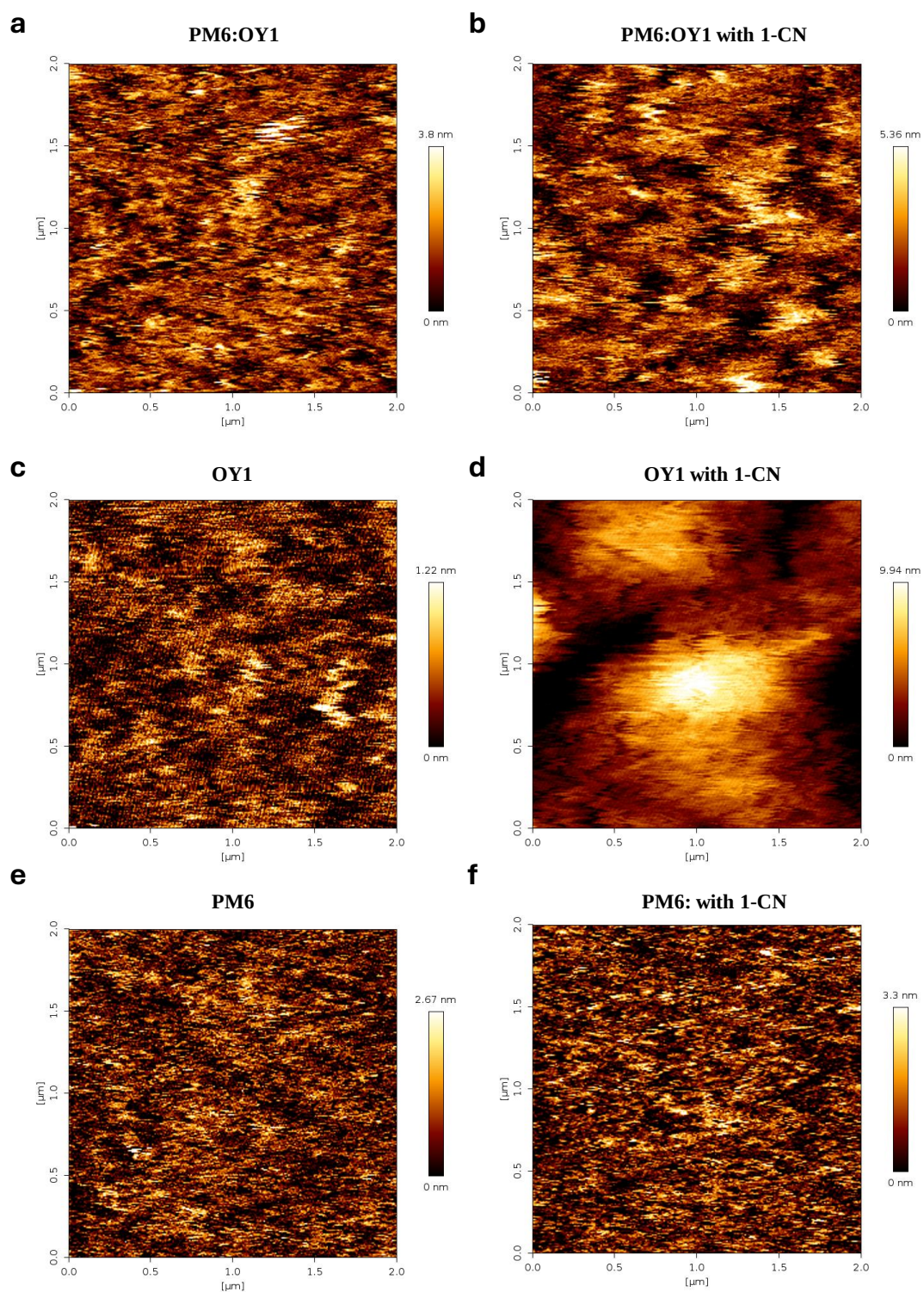


Fig. S3 Comparing AFM height images in (a,b) PM6:OY1 blend film, (c,d) pristine OY1, and (e,f) pristine PM6 films without and with 1-CN solvent additive.

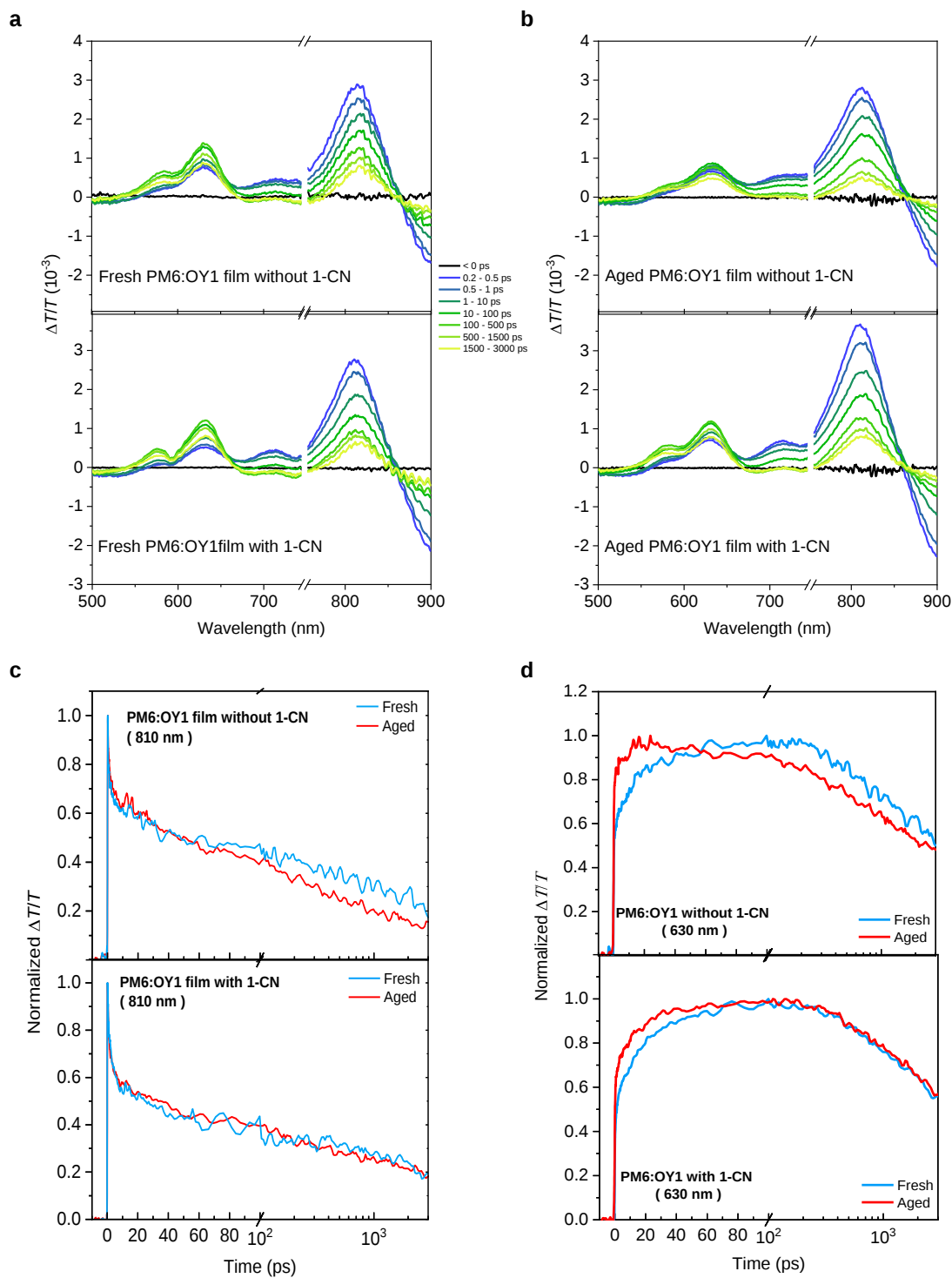


Fig. S4 TA spectra of PM6:OY1 blend films with and without 1-CN additive, before and after 250-h 1-sun light soak aging. (a,b) TA spectra of fresh/aged PM6:OY1 films without/with 1-CN additive; (c,d) the normalized kinetics of the OY1 ground state bleaching (GSB) region (810 nm) and PM6 GSB region (630 nm), obtained from fresh/aged PM6:OY3 without/with 1-CN additive (excited by a 750 nm laser).

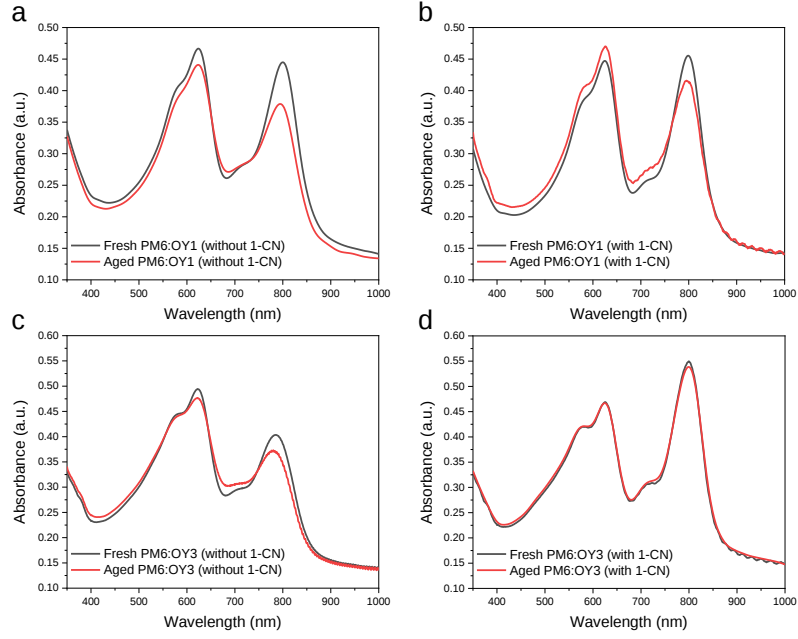


Fig. S5 UV-Vis absorption measurements of **(a,b)** fresh/aged PM6:OY1 and **(c,d)** PM6:OY3 blend with/without 1-CN. The aged samples were illuminated under one sun for 250 h.

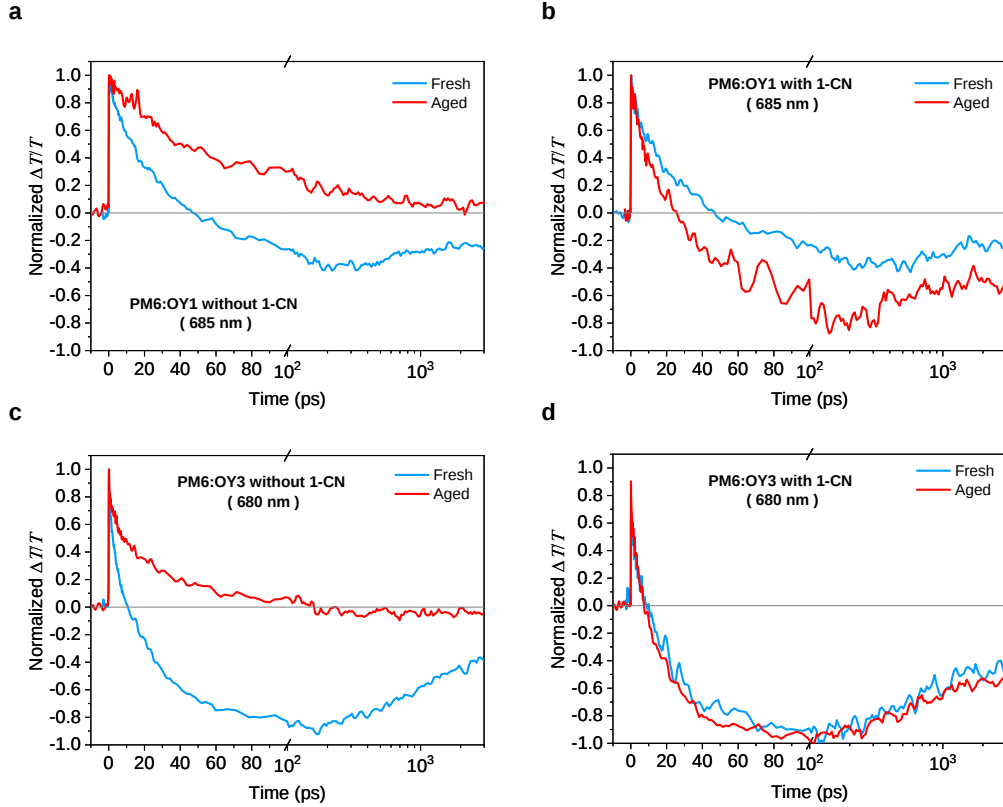


Fig. S6 Fresh/aged TA decay kinetics of PIA signals for PM6:OY1 **(a,b)** and PM6:OY3 **(c,d)** with and without 1-CN additives.

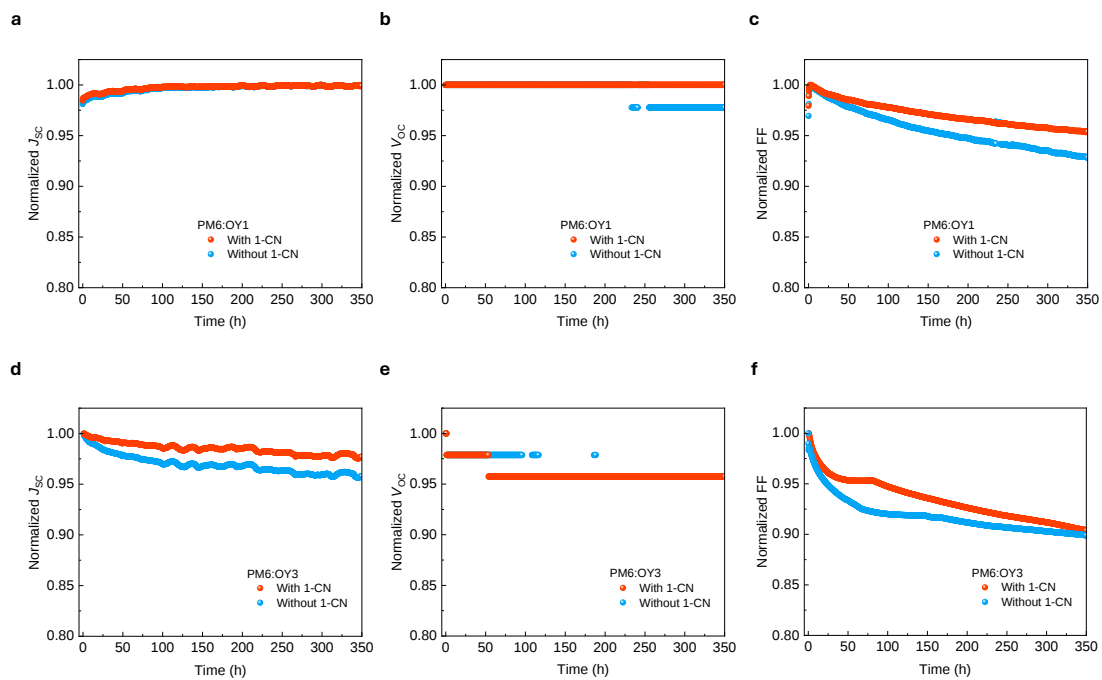


Fig. S7 Evolution of J_{sc} ; V_{oc} ; fill factor of PM6:OY1 (**a, b, c**) and PM6:OY3 (**d, e, f**) devices with and without 1-CN solvent additive under 350 h continuous illumination (AM 1.5).

Table S1 Photovoltaic performance of devices in this study. (All devices adopted D/A ratio of 1:1 and concentration of 12 mg mL⁻¹)

Materials	Solvents	V_{oc} (V)	J_{sc} (mA cm ⁻²)	FF (%)	PCE (%)	PCE _{max} (%)
PM6:OY1	CF	0.91	20.83	65.07	12.42	12.94
PM6:OY1	CF+1% CN	0.92	19.41	65.65	11.83	12.93
PM6:OY3	CF	0.97	23.69	64.41	14.81	14.94
PM6:OY3	CF+1% CN	0.97	20.00	70.27	13.69	14.47