Supporting Information

A multi-modal approach to understanding

degradation of organic photovoltaic materials

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1. AIPS waterfall plots for neat and blended films



Figure S1. Fractional absorptance (FA) vs wavelength progression for neat PDPP4T over 120 hours of ambient light exposure.



Figure S2. FA vs wavelength progression for neat IEICO-4F over 120 hours of ambient light exposure.



Figure S3. FA vs wavelength progression for neat $PC_{60}BM$ over 120 hours of ambient light exposure.



Figure S4. FA vs wavelength progression for 1:1 blended PDPP4T:IEICO-4F over 120 hours of ambient light exposure.



Figure S5. FA vs wavelength progression for 1:1 blended PDPP4T:PC₆₀BM over 120 hours of ambient light exposure.



2. AIPS lamp profile used for photobleaching

Figure S6. AIPS photobleaching spectrum. Note: Samples for TRMC, GIWAXS, and GISAXS were part of Batch 1 and samples for displayed AIPS data and XPS were part of Batch 2 (after bulb replacements).

3. TRMC transients with biexponential fits



Figure S7. Non-normalized TRMC transients with biexponetial fits for as-cast and δ -degraded **a**) 1:1 blended PDPP4T:IEICO-4F and **b**) 1:1 blended PDPP4T:PC60BM films.



4. XPS core level spectra for neat and blended dark controls

Figure S8. C 1s, O 1s, N 1s and S 2p core level XPS spectra for neat PDPP4T as-cast and left in the dark for 120 hours.



Figure S9. C 1s, O 1s, F 1s, N 1s and S 2p core level XPS spectra for neat IEICO-4F as-cast and left in the dark for 120 hours.



Figure S10. C 1s and O 1s core level XPS spectra for neat PC₆₀BM as-cast and left in the dark for 120 hours.



Figure S11. C 1s, O 1s, F 1s, N 1s and S 2p core level XPS spectra for 1:1 blended PDPP4T:IEICO-4F as-cast and left in the dark for 120 hours.



Figure S12. C 1s, O 1s, N 1s and S 2p core level XPS spectra for 1:1 blended PDPP4T:PC₆₀BM as-cast and left in the dark for 120 hours.



5. XPS core level spectra for neat and blended degraded samples

Figure S13. C 1s, O 1s, N 1s and S 2p core level XPS spectra for neat PDPP4T as-cast, degraded to δ -degraded setpoints, and degraded for 120 hours.



Figure S14. C 1s, O 1s, F 1s, N 1s and S 2p core level XPS spectra for neat IEICO-4F as-cast, degraded to δ-degraded setpoints, and degraded for 120 hours.



Figure S15. C 1s and O 1s core level XPS spectra for neat $PC_{60}BM$ as-cast, degraded to δ -degraded setpoints, and degraded for 120 hours.



Figure S16. C 1s, O 1s, F 1s, N 1s and S 2p core level XPS spectra for 1:1 blended PDPP4T:IEICO-4F as-cast, degraded to δ -degraded setpoints, and degraded for 120 hours.



Figure S17. C 1s, O 1s, N 1s and S 2p core level XPS spectra for 1:1 blended PDPP4T:PC₆₀BM as-cast, degraded to δ -degraded setpoints, and degraded for 120 hours.



6. GIWAXS 2D detector images and associated 1D integrations

Figure S18. GIWAXS 2-dimensional intensity vs. q-space detector images of films as-cast and degraded to the δ -degraded setpoint for **a**) neat PDPP4T, **b**) neat IEICO-4F, **c**) neat PC₆₀BM, **d**) 1:1 blended PDPP4T:IEICO-4F, and **e**) 1:1 blended PDPP4T:PC₆₀BM.



Figure S19. GIWAXS 1-dimensional intensity vs. q_z -space (top) and q_{xy} -space (bottom) integrated cake slices of films as-cast and degraded to the δ -degraded setpoint for **a**) neat PDPP4T, **b**) neat IEICO-4F, **c**) neat PC₆₀BM, **d**) 1:1 blended PDPP4T:IEICO-4F, and **e**) 1:1 blended PDPP4T:PC₆₀BM. Note: the 1.54 Å⁻¹ (4.08 Å) peak is characteristic of the ITO substrate.



7. GISAXS 2D detector images and associated 1D integrations

Figure S20. GISAXS 2-dimensional intensity vs. q-space detector images of films as-cast and degraded to the δ -degraded setpoint for **a**) 1:1 blended PDPP4T:IEICO-4F, and **b**) 1:1 blended PDPP4T:PC₆₀BM.



Figure S21. GISAXS 1-dimensional intensity vs. q-space integrated slices with fits of films ascast and degraded to the δ -degraded setpoint for **a**) 1:1 blended PDPP4T:IEICO-4F, and **b**) 1:1 blended PDPP4T:PC₆₀BM.