Supporting Information

Ambient Air Processing Causes Light Soaking Effects in Inverted Organic Solar Cells Employing Conjugated Polyelectrolyte Electron Transfer Layer

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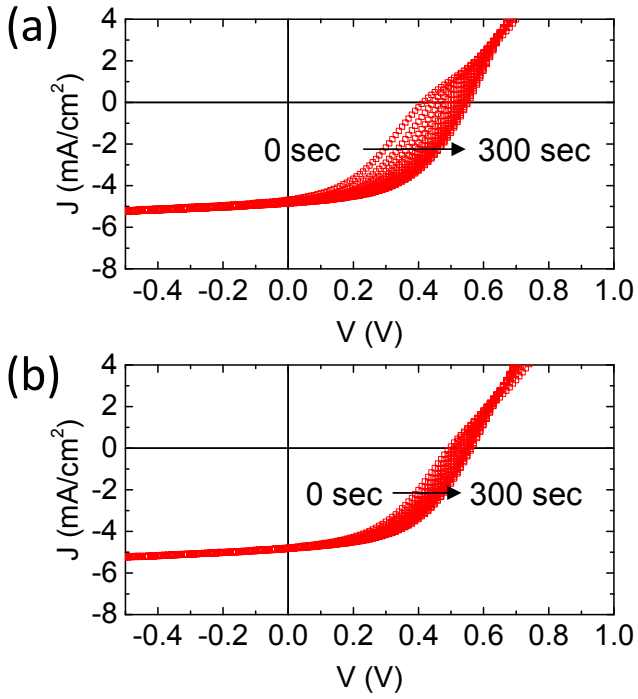

Figure S1. Representative *J-V* characteristics of inverted P3HT:PCBM BHJ solar cells (ITO/ PFN/P3HT:PCBM/MoO_3/Au) showing reversible degradation after the initial light soaking. (a) The initial light soaking behavior during the first 300 s solar illumination (indicated by an arrow) under AM1.5G, 1 sun solar illumination. (b) Remeasured light soaking behavior of the same device after 12 hr storage under dark condition in vacuum.

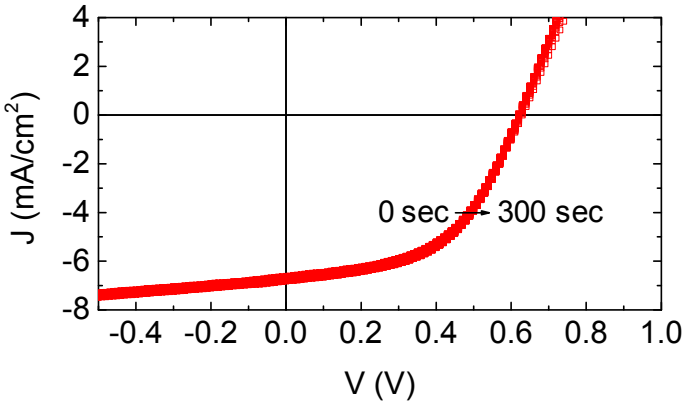

Figure S2. Representative *J-V* characteristics of an air-processed non-inverted P3HT:PCBM BHJ solar cell having a structure of ITO/MoO_3/P3HT:PCBM/PFN/Al during a 300 s light soaking (indicated by an arrow) under AM1.5G, 1 sun solar illumination. The negligible change in *J-V* characteristics during the light soaking confirms the PFN/P3HT:PCBM interface does not cause the light soaking phenomenon observed in the inverted counterpart (ITO/PFN/P3HT:PCBM/MoO_3/Au).

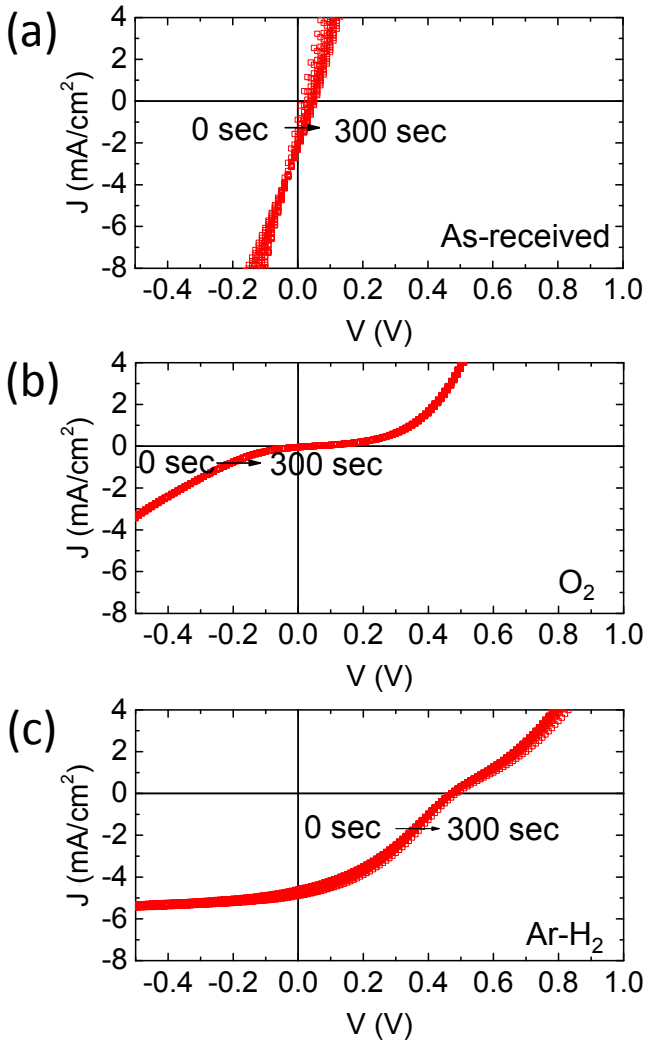

Figure S3. Representative *J-V* characteristics of inverted P3HT:PCBM BHJ solar cells having no PFN (ITO/P3HT:PCBM/MoO_3/Au) with different ITO surface treatment conditions during a 300 s light soaking (indicated by arrows) under AM1.5G, 1 sun solar illumination. (a) As-received, (b) O_2-plasma-treated, and (c) Ar-4% H_2-plasma-treated ITO. All plasma treatments were performed under 20 W and 100 mTorr for 5 min. Negligible light soakings effects on these devices show that the intrinsic ITO work function decrease by oxygen desorption during solar illumination alone cannot explain the light soaking phenomenon involving PFN interlayer. In contrast to negligible rectification for the as-received ITO, O_2-plasma renders the *J-V* curve diode-like but without photovoltaic action. This seems to indicate oxidation of active organic layer in contact with adsorbed oxygen on ITO (thus increased contact resistance), the same mechanism that creates charge traps in PFN.