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Indoor Light Recycling: A New Home for Organic Photovoltaics

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Devices were fabricated on indium tin oxide (ITO) coated glass substrates with resistance of ~60 Ω. Substrates were cleaned by sonicating 20 min each in DI water with Fisher VersaClean soap, DI water, acetone, and isopropanol, then drying at least 2 hours in 140 ºC oven and storing in oven until ready to use. Heraeus Clevios P VP 4083 PEDOT:PSS hole transporting layer (HTL) was spin coated onto the substrates at 2500 rpm for 40 s, annealed in 140 ºC oven for 30 min, then removed and kept at room temperature for no more than 24 h before spin coating active layer.

P3HT:PC60BM bulk heterojunction (BHJ) active layer was spin coated in air from a 20 mg/mL 1:0.8 molar ratio solution in chlorobenzene at 1000-1200 rpm for 60 s with 1.0 s ramp, then annealed at 150 ºC for 10 min in a glovebox.

P3HT:PC60BM nanoparticle (NP) solution consisted of 1:1 ratio of separate P3HT and PC60BM nanoparticles (~80±20 nm diameter) stabilized by sodium dodecyl sulfate in water. This solution was spin coated at 1100 rpm for 10 s with a 0.5 s ramp, then 1400 rpm for 20 s with a 0.5 s ramp, then 2000 rpm for 10 s. 15 mg/mL $PC_{60}BM$ solution in DCM was then spin coated on top at 1000 rpm for 30 s, then 2000 rpm for 10 s.

PCE10:PC70BM BHJ active layer was spin coated in a glovebox from a 1:1.8 weight ratio solution in chlorobenzene:1,8-diiodooctane (3 v% DIO) which was stirred at 55 °C for 1 day. DIO was removed under vacuum. 15 nm of C_{60}-N was spin-coated on top.

$MAPbI_3$ and $MA_{0.5}FA_{0.5}PbI_3$ devices were fabricated by spin coating 400 mg/mL PbI_2 solution in DMF at 6000 rpm for 35 s, followed by annealing at 75-80 °C for 45 min. On top of this was spincoated a 40 mg/mL solution of either MAI or 1:1 MAI:FAI at 6000 rpm for 35 s, followed by annealing at 75-80 °C for 45 min. 20 mg/mL $PC_{60}BM$ solution in chlorobenzene was then spin coated on top at 1000 rpm for 60 s, then 2000 rpm for 10 s.

15 nm of Ca followed by 100 nm of Al as cathode electrode was thermally deposited at 10^{-6} mbar pressure on top of the active layer of $MAPbI_3$, $MA_{0.5}FA_{0.5}PbI_3$, and P3HT:$PC_{60}BM$ BHJ and NP devices. 100 nm of Ag was thermally deposited at 10^{-6} mbar pressure on top of the active layer of PCE10:$PC_{70}BM$ BHJ devices. All devices fabricated in house had active area of 6 mm^2 and 4 devices per substrate.

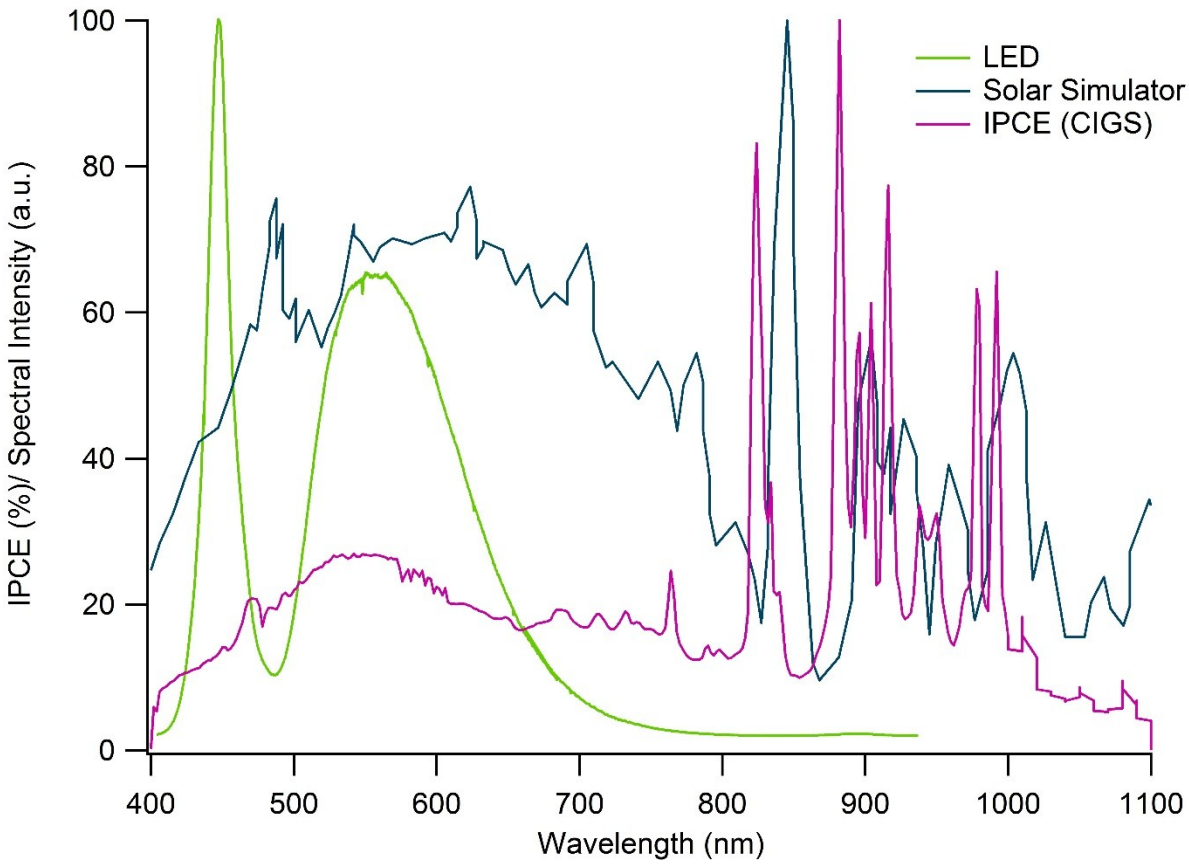

Figure S1: Incident photon-to-electron conversion efficiency for Nanosolar Nanocell copper indium gallium selenide (CIGS) photovoltaic cell. Also shown are the emission spectra of an AM1.5G solar simulator and a commercial white LED light.