Interfacial charge transfer dynamics in CdSe/dipole molecules coated quantum dot polymer blends.

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SUPPLEMENTARY INFORMATION
1. CdSe nanocrystal synthesis and ligand exchange.

CdSe quantum dots were synthesized using the wet chemical synthetic method previously described by Nazeeruddin et al. with few modifications. A Se solution was prepared by mixing 0.4g of Se powder, 10 mL of TOP (Trioctylphosphine) and 0.2 mL of anhydrous toluene. 20 g of TOPO (Trioctylphosphine oxide) and 0.25 g of cadmium acetate dihydrate were placed in a round-bottomed flask and heated until 150ºC. The solution was purged with argon during the whole reaction. When all the TOPO was dissolved the solution was heated up to 290ºC. At this temperature, the Se solution was quickly injected into the reaction vessel through a rubber septum. The heat was removed 15 minutes later and the resulting solution was cooled to room temperature. The CdSe quantum dots were precipitated with a copious amount of methanol and collected by centrifugation and decantation. This purification was repeated three times. The precipitated Cdse quantum dots were recovered by adding Toluene up to a final concentration of 20 mg/mL.

The TOPO capped CdSe quantum dots were then exchanged by several molecules. In the case of the pyridine coated CdSe quantum dots, the TOPO-coated CdSe were dissolved in 40 mL of pyridine and refluxed at 90ºC overnight under dark conditions. The substituted benzenethiol-coated Cdse were obtained re-dispersing the TOPO-coated CdSe (1.5 mL) in a mixture of 3.5 g anhydrous toluene and 0.1 mol of each substituted benzenethiol molecule. The solution was refluxed for 24 hours under Ar conditions at 70ºC. Finally, the QD were dispersed in Chloroform at 20 mg/mL.

2. Morphologic and Spectroscopic measurements.
Atomic Force Microscopy of the samples (AFM) was performed on tapping mode on a Molecular Imaging model Pico SPM II (pico +). Film thickness was measured with an Ambios Technology XP-1 Profilometer.

The UV-Visible spectra were recorded using a Shimadzu UV-1700 spectrophotometer. FTIR Characterization was performed in a NICOLET 5700 FT-IR using a liquids holder with KBr windows. The emission properties were measured under ambient conditions using a Aminco Bowman Series 2 luminiscence spectrometer. Time Correlated Single Photon Counting (TCSPC) experiments were carried out with lifespec.red picosecond fluorescence lifetime spectrophotometer from Edinburgh Instruments© equipped with lasers as excitation sources. The instrument response was always shorter than 300 ps measured at full width half maximum (FWHM). Laser Transient Absorption Spectroscopy (L-TAS) were recorded using a home-built system as reported before 3. The samples were measured with a probe wavelength of 980 nm and an excitation soured of 470nm. Laser intensity pulse was 86.7 $\mu$J/cm$^2$, repetition rate 1 Hz.


Pre-cleaned ITO (Indium doped tin oxide) substrates were used as anode. A thin layer (30nm) of poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS) was deposited by spin coating. The PEDOT:PSS layers were annealed at 100ºC in air conditions. Over the PEDOT:PSS layer, the P3HT:CdSe blends were spined, obtaining films of 150 nm, and annealed at 150ºC for 30 minutes. Finally, thermal evaporation of 100 nm Al was done at 10$^{-6}$ mbar. The final area of he devices was of 9 mm$^2$.

The I-V characteristics of the devices were carried out automatically with a Keithley model 2600 digital source meter using Labview software.
