Supporting Information

Dielectric Screening to Reduce Charge Transfer State Binding Energy in Organic Bulk Heterojunction Photovoltaics

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The exponentially modified Gaussian function used to fit the EL spectra is shown below.

$$f(x) = y_0 + \frac{A}{t_0} e^{\frac{1}{2}(\frac{w}{t_0})^2 - \frac{x - x_c}{t_0}} \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{-\frac{y^2}{2}} dy$$

where $z = \frac{x - x_c}{w} - \frac{w}{t_0}$

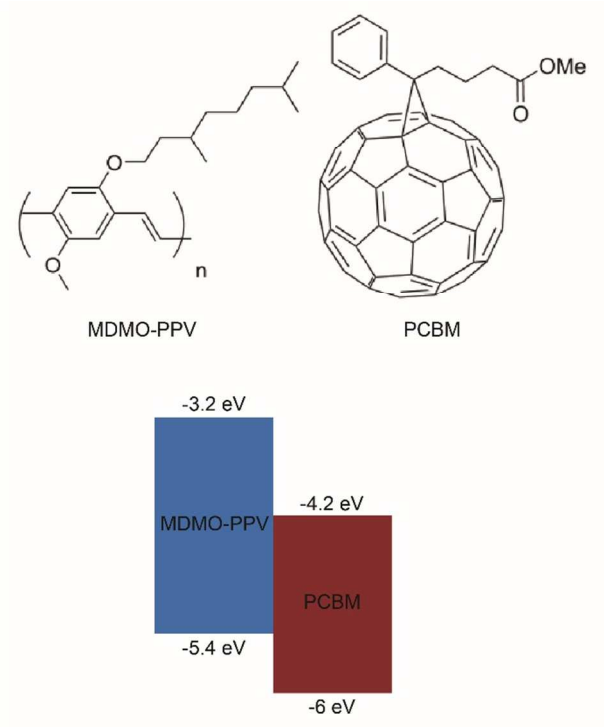

Figure S1. Molecular structures of MDMO-PPV and PCBM and their band alignment[56].

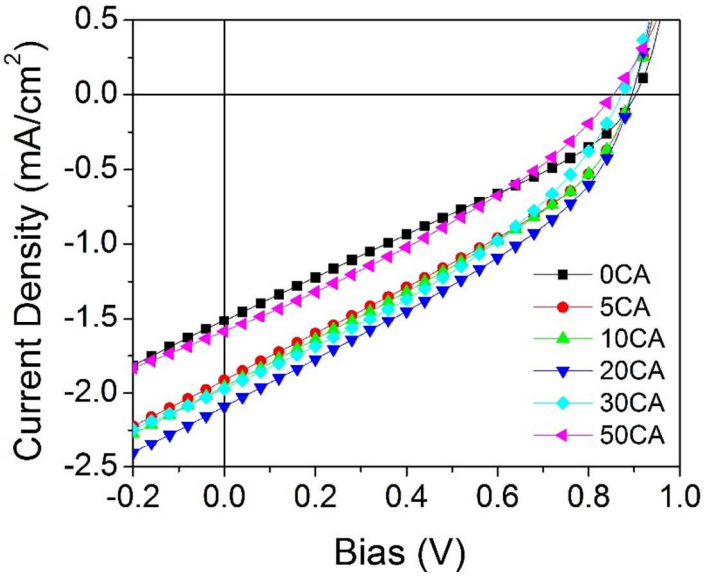

Figure S2. Illuminated current density-voltage curves for MDMO-PPV:PCBM:CA BHJ devices with varying concentrations of CA. The highest performing cells for each concentration are plotted. The concentrations vary from 0 to 50 wt% CA.

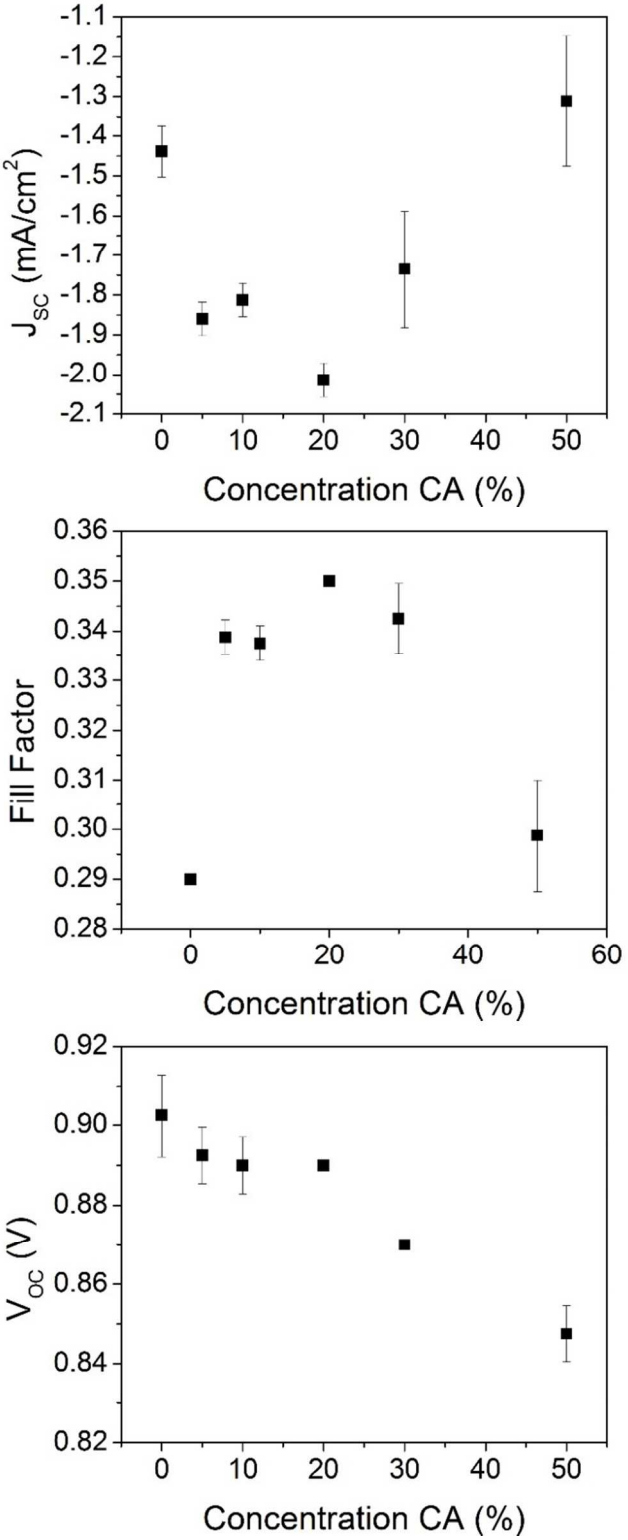

Figure S3. Average J_{SC}, FF, and V_{OC} of 8 devices with increasing wt% of CA blended in the BHJ. The error bars represent the standard deviation. Both FF and J_{SC} are optimized at 20 wt% CA. The V_{OC} decreases as more CA is added.

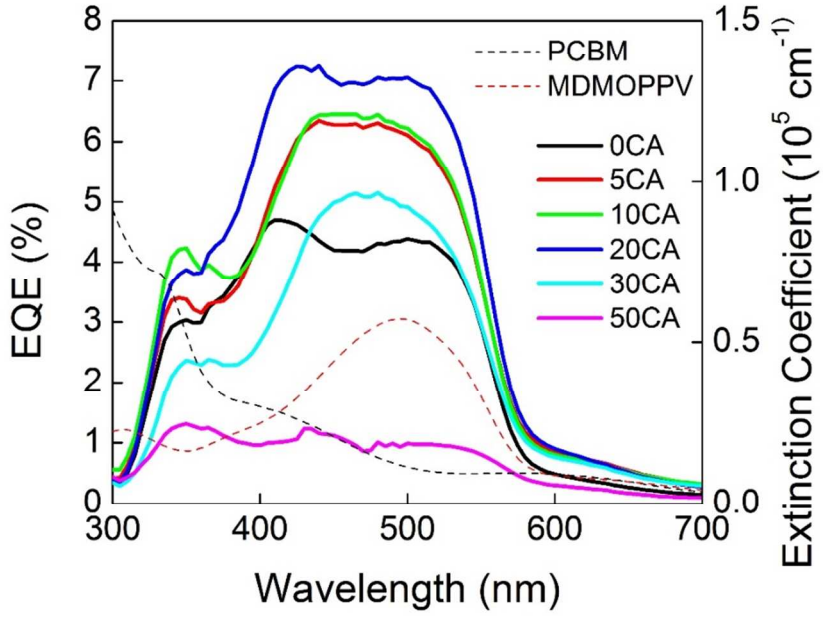

Figure S4. Raw external quantum efficiency (EQE) spectra of BHJ devices with CA in solid lines and extinction coefficients for MDMO-PPV and PCBM in dashed lines. The maximum EQE, across almost the entire spectrum, is achieved at 20 wt% CA.

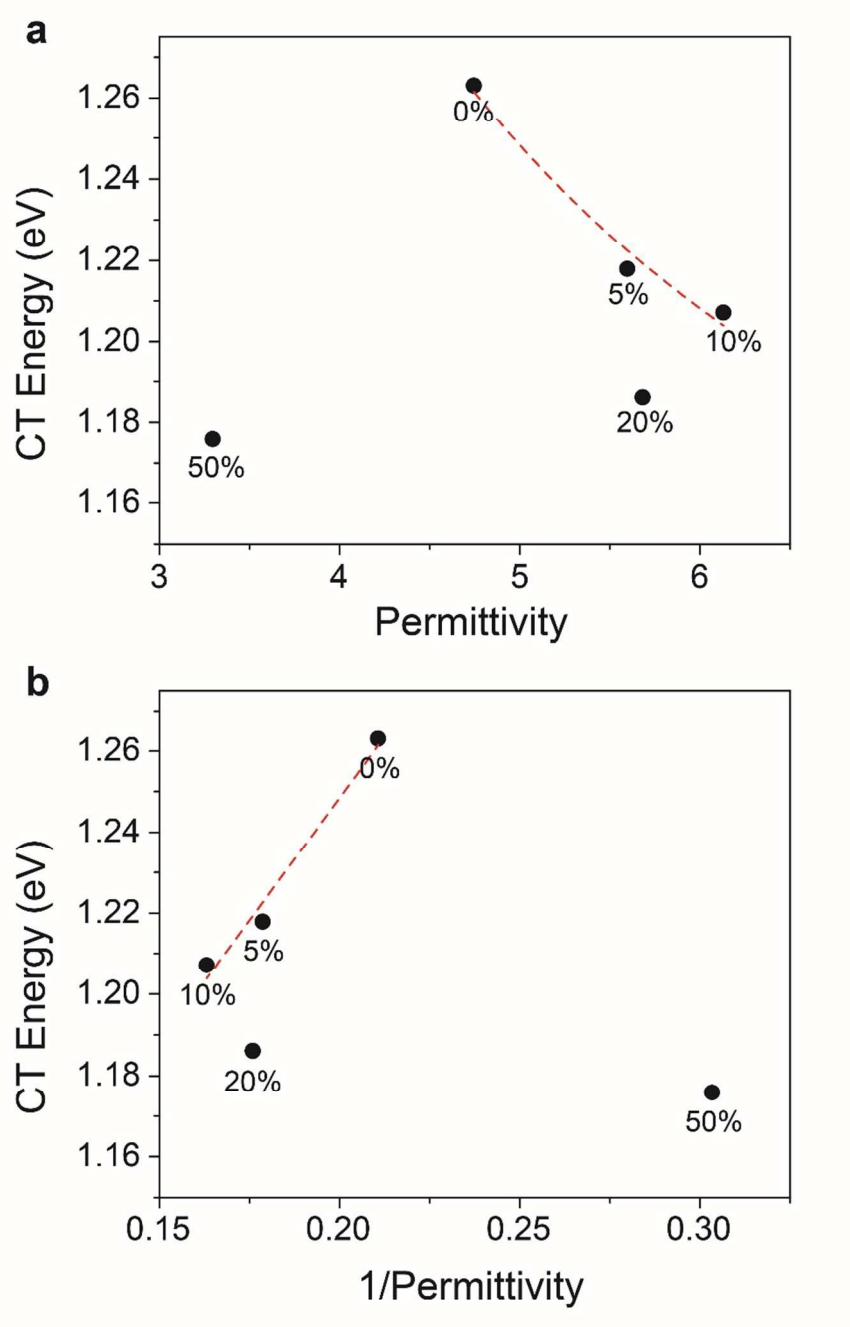

Figure S5. Fitting data to Coulombic and SSSE models. (a) CT state plotted against permittivity only shows a trend towards the SSSE behavior (dashed line) for the films with CA concentrations up to 10 wt%[33]. The SSSE fit is based on the equation $E_{CT} = C - A\big((2(1-\varepsilon))/(2\varepsilon - 1)\big)$, where E_{CT} is the CT state energy, C and A are constants, and ε is the permittivity. (b) In the Coulombic model, the CT state energy is inversely related to the permittivity. The dashed line is a linear fit for data from films with CA concentrations up to 10 wt%. The wt% CA for each data point is labeled.