Supporting information

Choline Chloride-based deep eutectic solvents as effective electrolytes for dye-sensitized solar cells

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Section S1. Chemicals, Supplies, and Instruments for the characterization of DES-CE and DES-CU

Chemicals, Supplies

Choline chloride (assay ≥99%), Urea (Urea, ACS reagent, 99.0-100.5%), Ethylene glycol (ReagentPlus®, ≥99%) were obtained from Sigma-Aldrich.

Analytical techniques

The ^{1}H NMR spectra were recorded on a Bruker Advance 500 instrument using $CDCl_3$ or MeOD as solvent and solvent peaks or TMS as internal standards. Thermal gravimetric analysis (TGA) was measured on a TA Q500 thermal analysis system with the sample held in a platinum pan in a continuous airflow. FT-IR spectroscopy was performed on a Bruker Vertex 70. Viscosity of ionic liquids was performed using Brookfield DV-III programmable Rheometer (at room temperature ~30 ^{o}C). The ionic conductivity of ILs was measured by using Conductimeter OAKION CON 2700. HRMS (ESI) data were recorded on Bruker micrOTOF-QII MS at 80 eV.

DSC fabrication

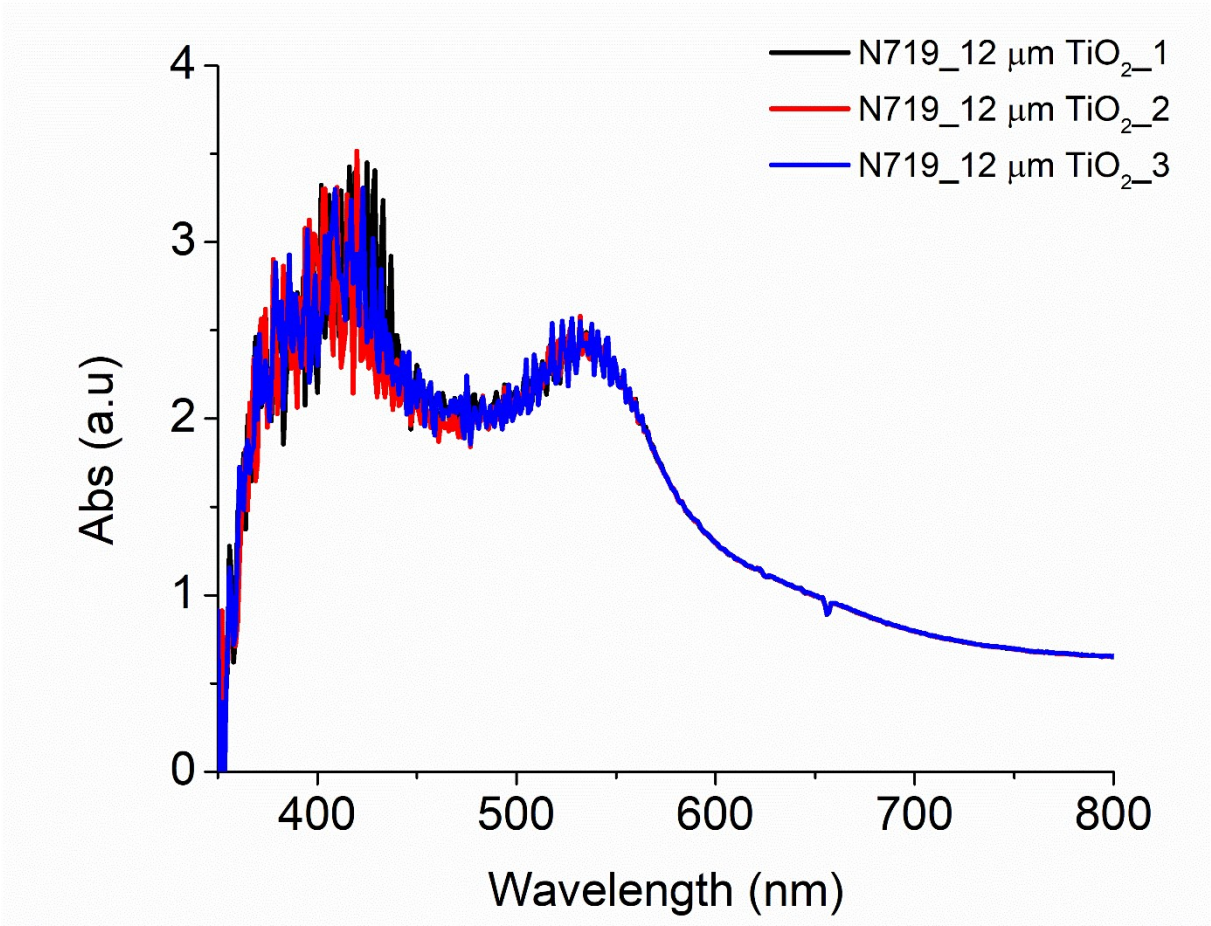

Figure S1. Absorption spectra of the TiO_2 loaded N719 dye photo-anodes. Thickness of TiO_2 layer is 12 μm.

Section S2. Characterization of DES

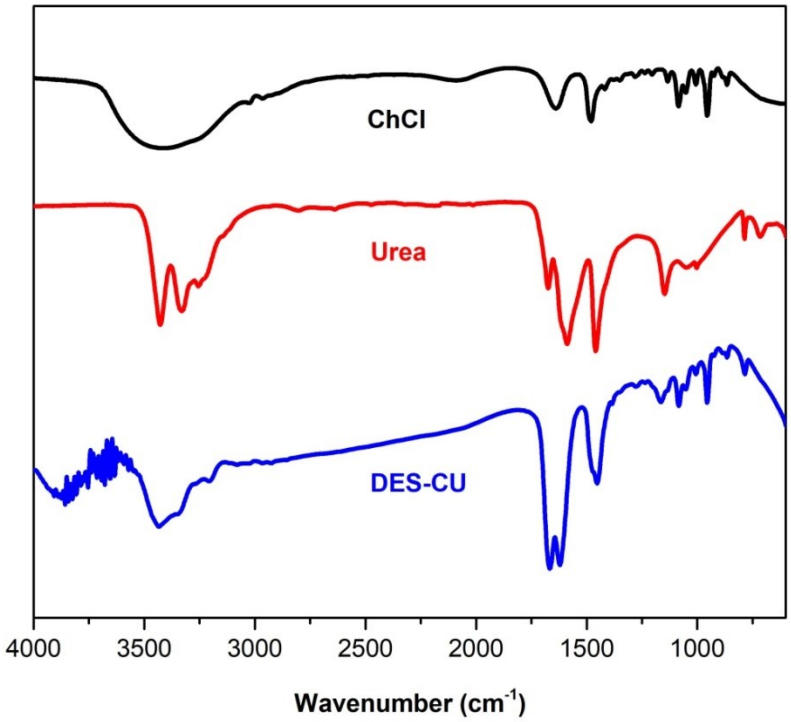

Figure S2. FT-IR spectra of pure choline chloride, pure urea, and DES-CU.

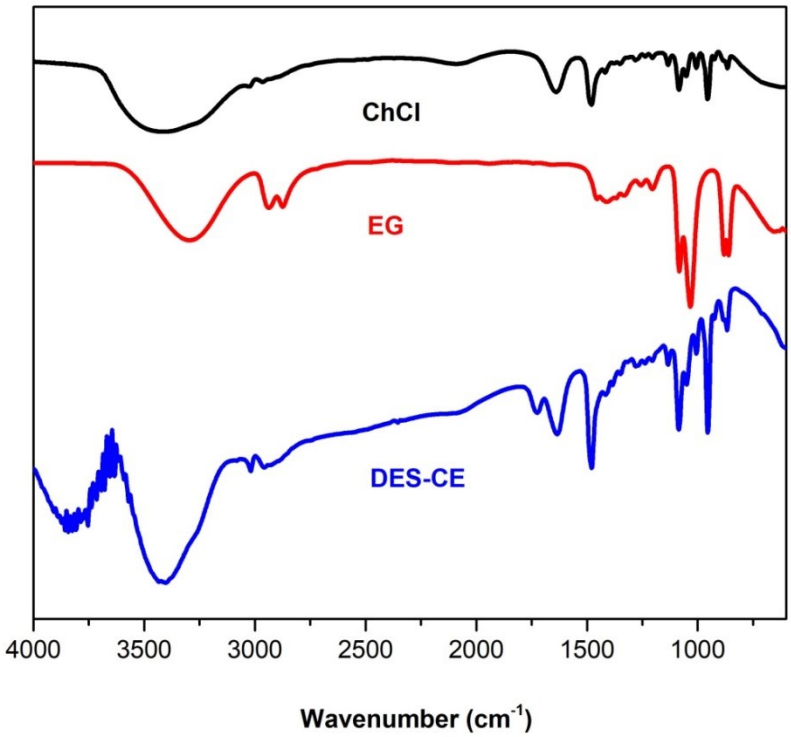

Figure S3. FT-IR spectra of pure choline chloride, pure ethylene glycol and DES-CE.

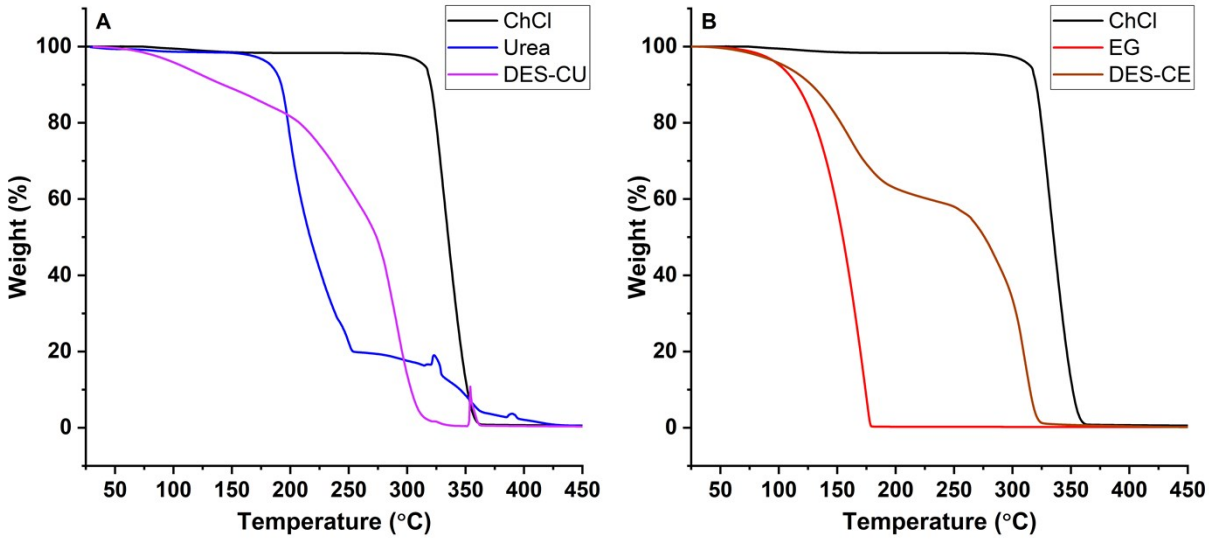

Figure S4. TGA spectra of (A) pure choline chloride, pure urea and DES-CU; (B) pure choline chloride, pure urea and DES-CE.

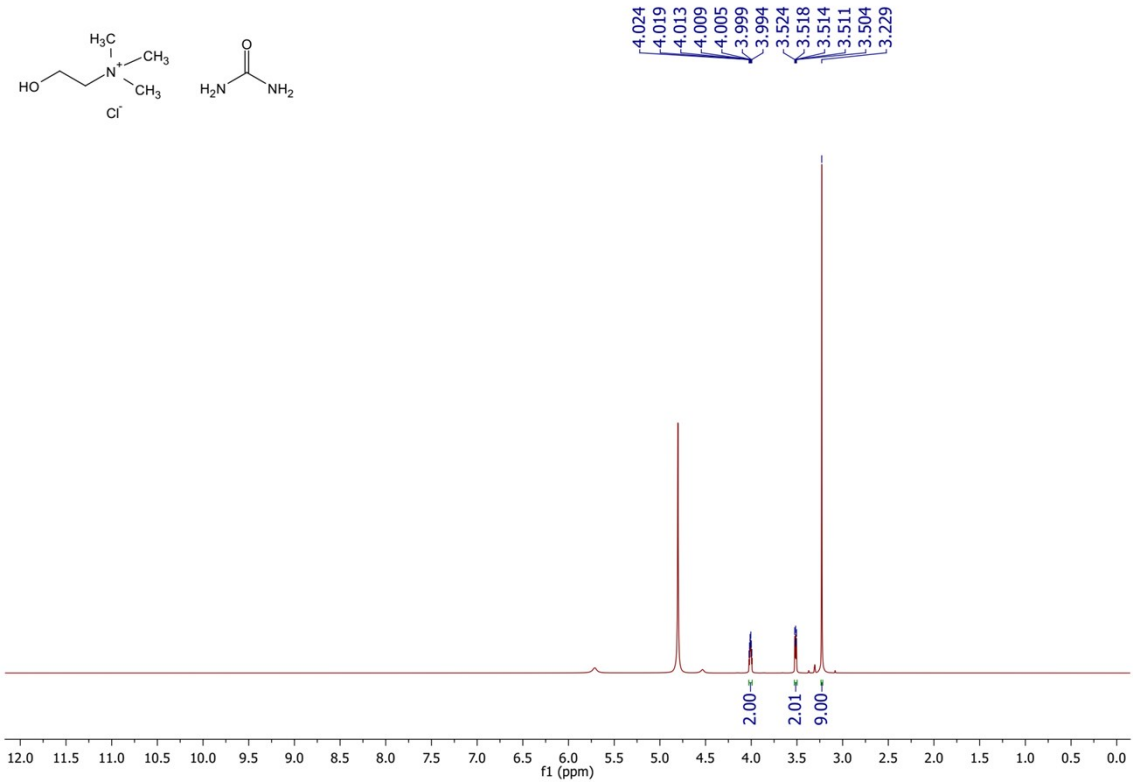

Figure S5. ^{1}H NMR spectrum of DES-CU (MeOD).

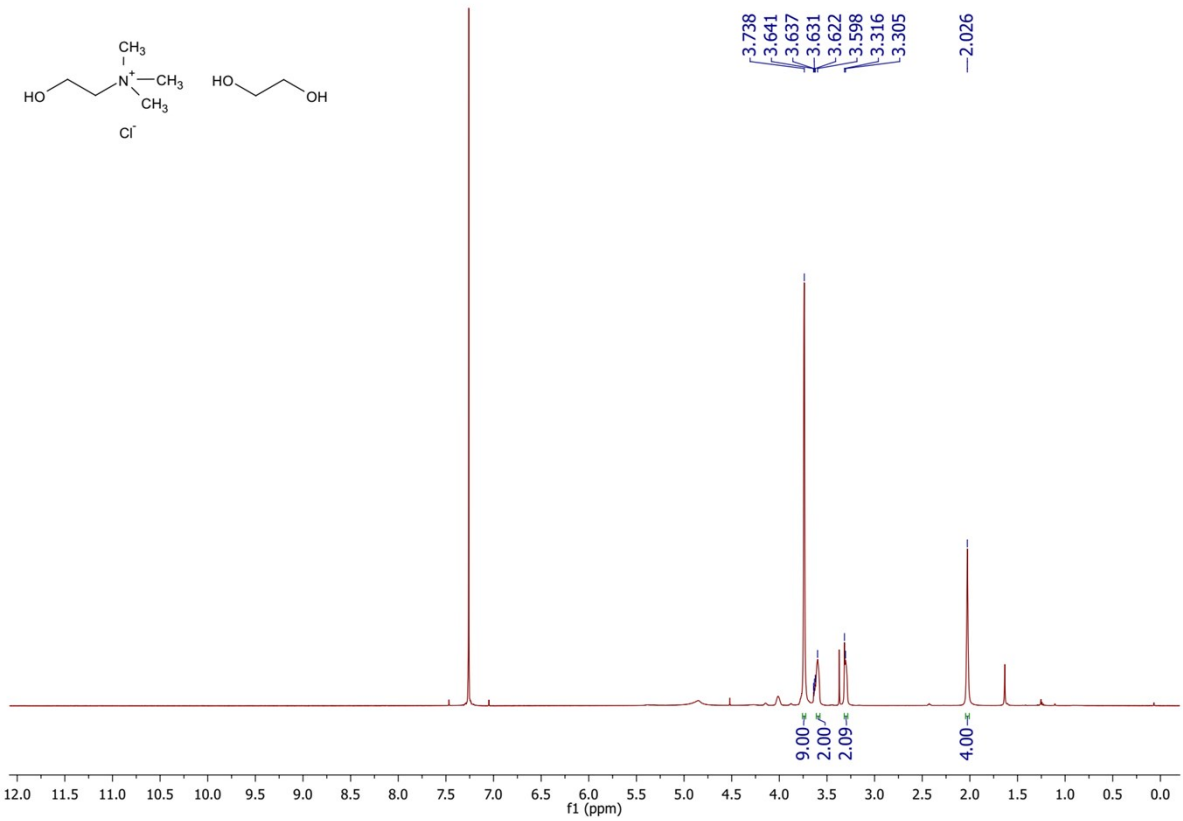

Figure S6. ^{1}H NMR spectrum of DES-CE ($CDCl_3$).

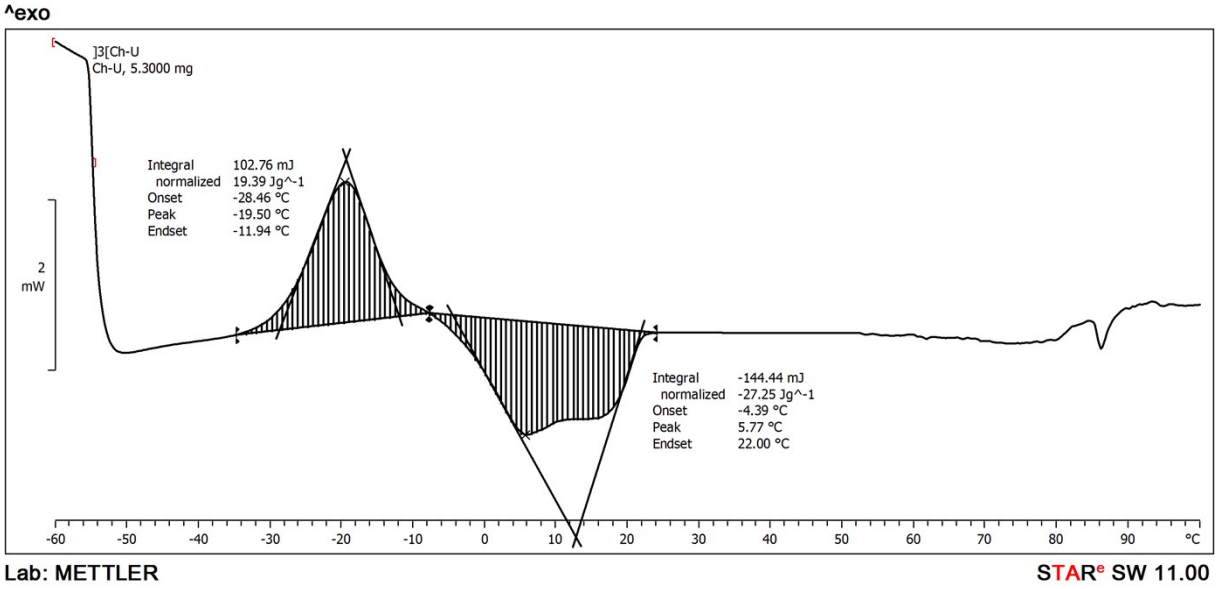

Figure S7. DSC spectrum of DES-CU.

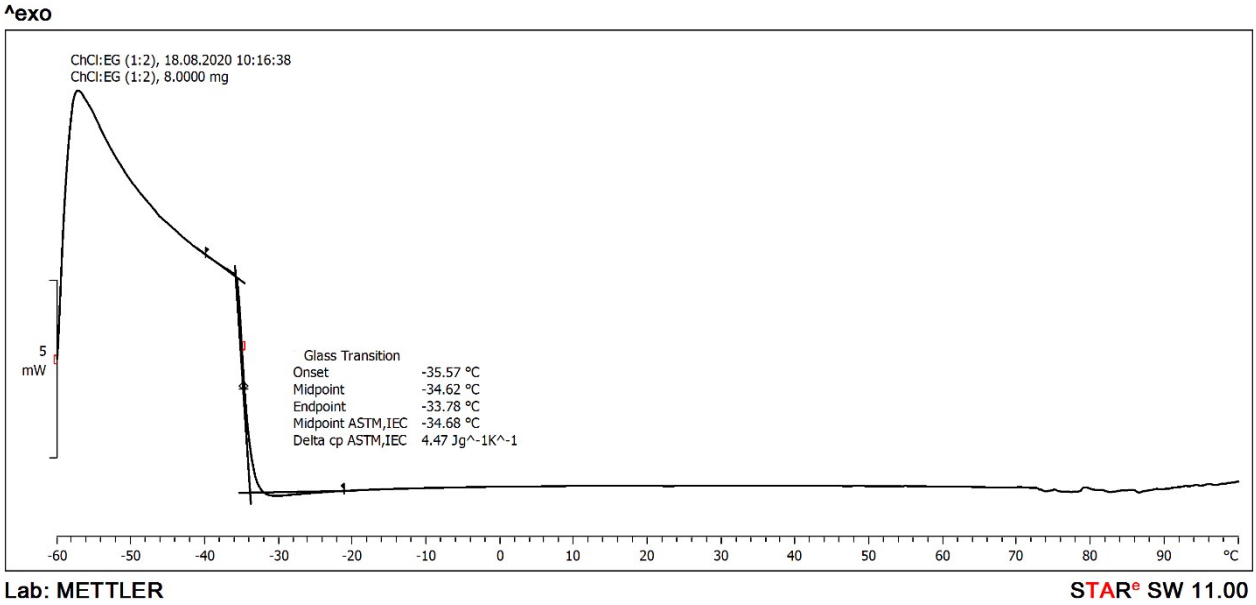

Figure S8. DSC spectrum of DES-CE.

Section S3. Characterization of DSC devices

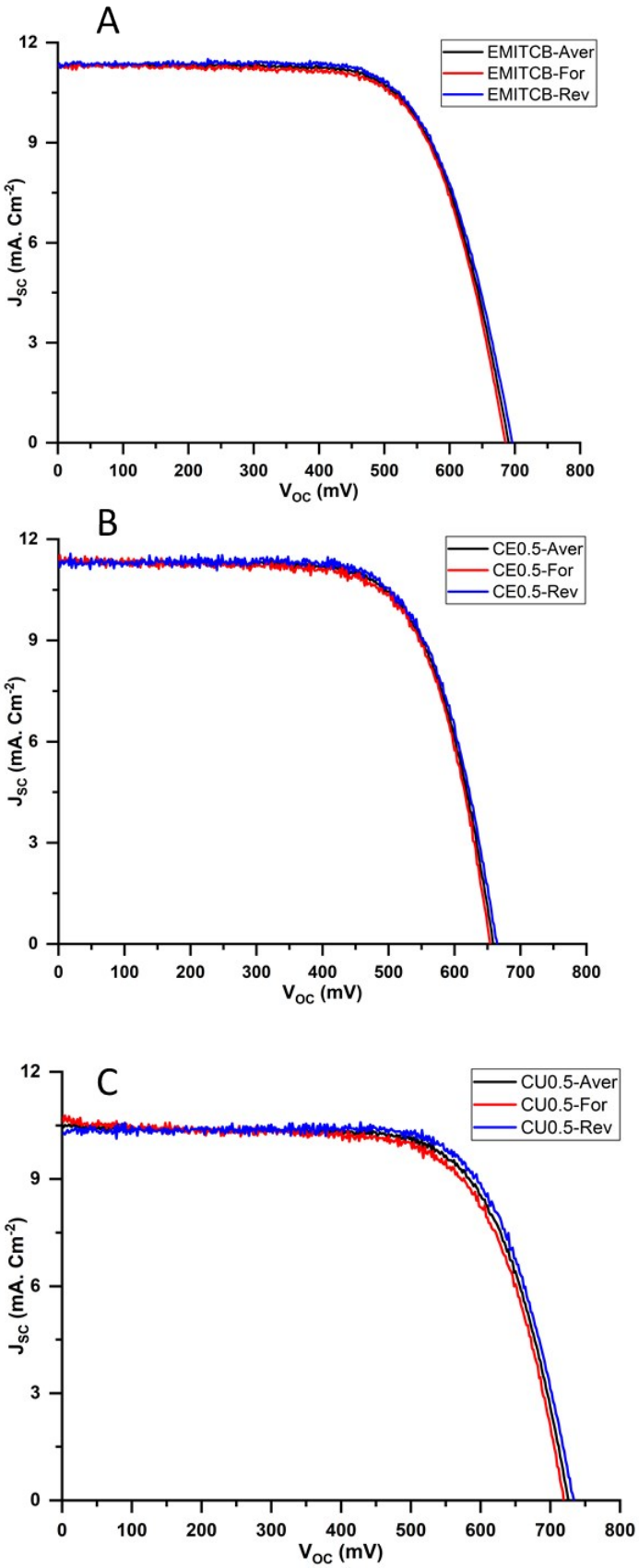

Figure S9. The forward and backward *J-V* curves of DSC devices fabricated with (A) EMTCB, (B) CE-0.5 and (C) CU-0.5 electrolytes was nearly the same, indicating no hysteresis effect in the measurement.