Electronic supplementary information

A High Energy Density Solar Rechargeable Redox Battery

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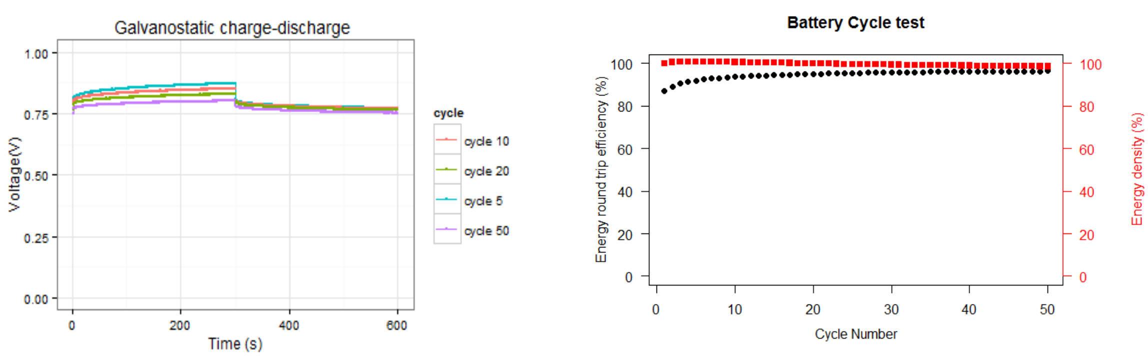
A cycle life test for 50 cycles is performed on the Iodine/Polysulfide battery (not the full solar battery) by galvanostatic charge/discharge at 0.2 mA/cm^2. The cycling results are depicted in the figure below. It shows great stability of the discharge voltage and near perfect round-trip efficiency and perfect preservation of the energy capacity over the cycles. This observation supports the suggestion that the loss of solvent at elevated temperatures is the main loss mechanism during photo-charging, as opposed to non-reversible electrochemistry of the redox couples.



(a) (b)

Figure S1: (a) Galvanostatic charge -discharge and (b) cycle life analysis of the redox battery at a constant current of 0.2 mAcm^{-2}. The electrodes and electrolytes are the same as the solar redox battery used in the manuscript (Pt Mesh | 1 M I2, 0.1 M NaI, 1 M NaClO4 in AcN/THF (2:1 v/v)| CMI-7000 CEM | 1 M Na2S, 3 M S, 1 M NaClO4 in AcN/THF (2:1 v/v) |Ni foam, acid/polysulfide pre-treated).

The conductivity of the membranes is studied using electrochemical impedance spectroscopy (EIS). CMI-7000 was chosen based on its higher low-frequency conductivity.

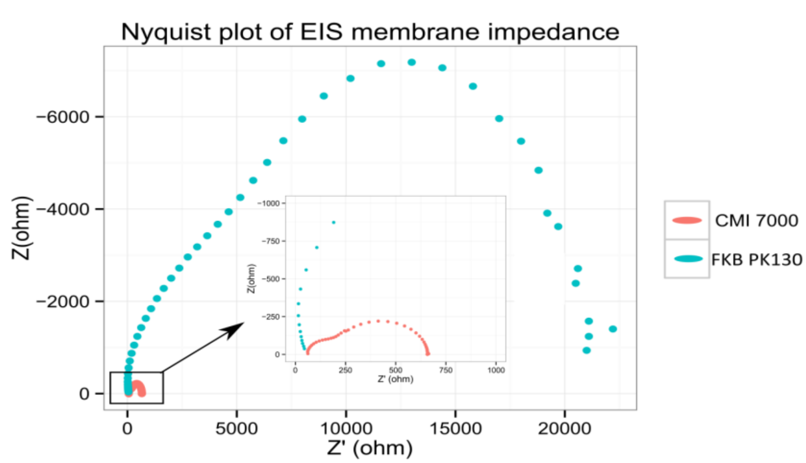


Figure S2: Nyquist plot of the Membrane International CMI-7000 and Fumatech FKB PK130 membranes measured in a 1 M NaClO4 in AcN/THF (2:1 v/v) solution. The frequency was swept between 0.1 Hz and 10^6 Hz. The area of the membranes was 0.35 cm^2.