

Supporting information

Volumetric double-layer charge storage in composites based on conducting polymer PEDOT and cellulose

Ihor Sahalianov^{a,†}, Mehmet Girayhan Say^{a,†}, Oliya S. Abdullaeva^a, Fareed Ahmed^a, Eric Glowacki^{a,b,c}, Isak Engquist^{a,c}, Magnus Berggren^{a,c}, Igor Zozoulenko^{a,c*}

[†]Authors contributed equally

*Corresponding author: igor.zozoulenko@liu.se

^aLaboratory of Organic Electronics, Department of Science and Technology, Linköping University, SE-601 74 Norrköping, Sweden

^b Central European Institute of Technology, Brno University of Technology, Purkynova 123, Brno, 61200 Czech Republic

^cWallenberg Wood Science Center, Linköping University, SE-601 74 Norrköping, Sweden

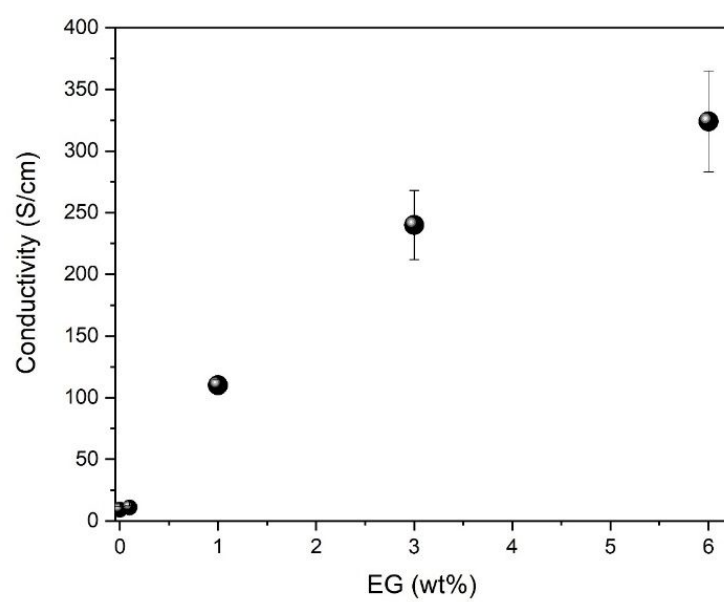


Figure S1. The electrical conductivity of Power Paper (9 μm) as a function of different EG concentrations. Power paper samples were fabricated for 6 wt% of EG.

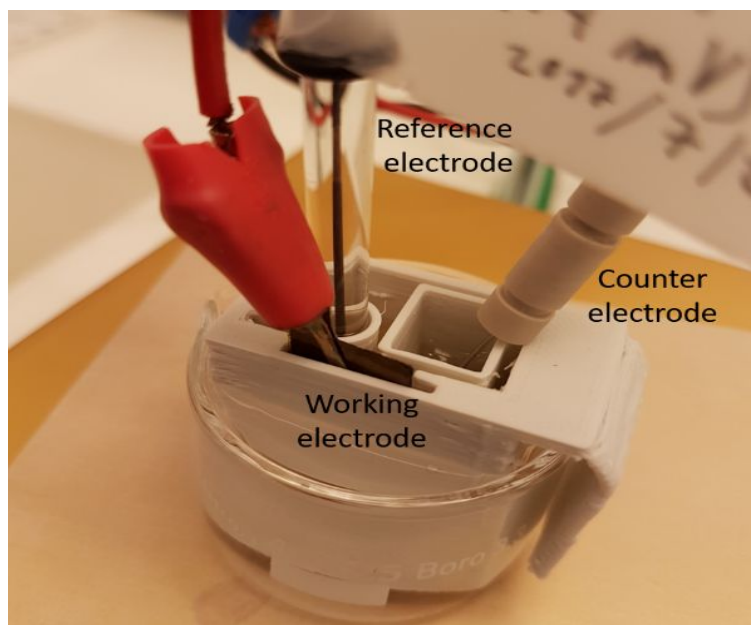


Figure S2. Picture of the three-electrode electrochemical cell.

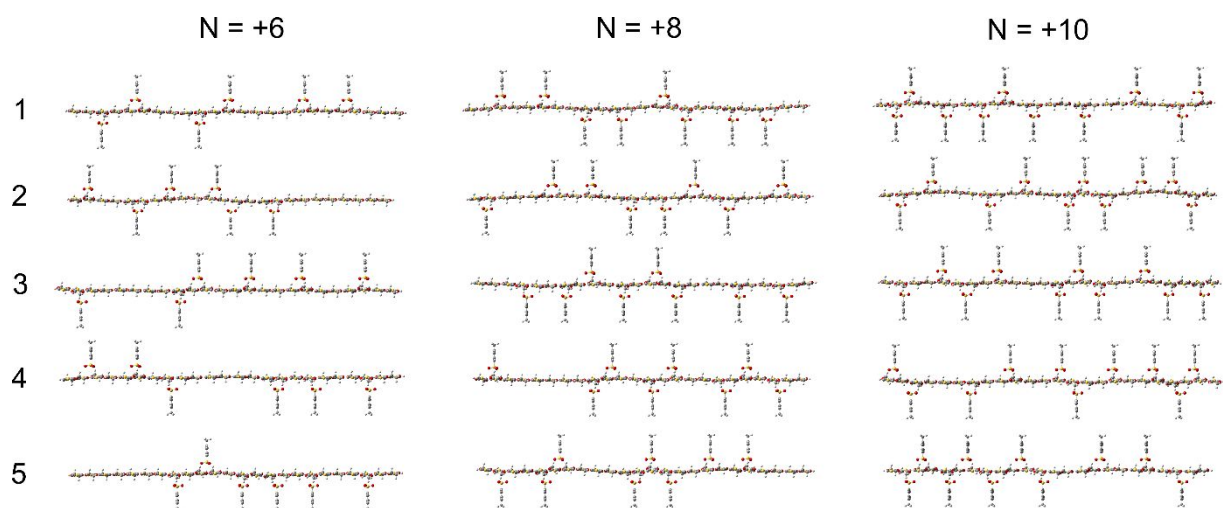


Figure S3. Examples of counterions configurations surrounding PEDOT oligomer for the first five different realizations at N = +6, +8, +10.

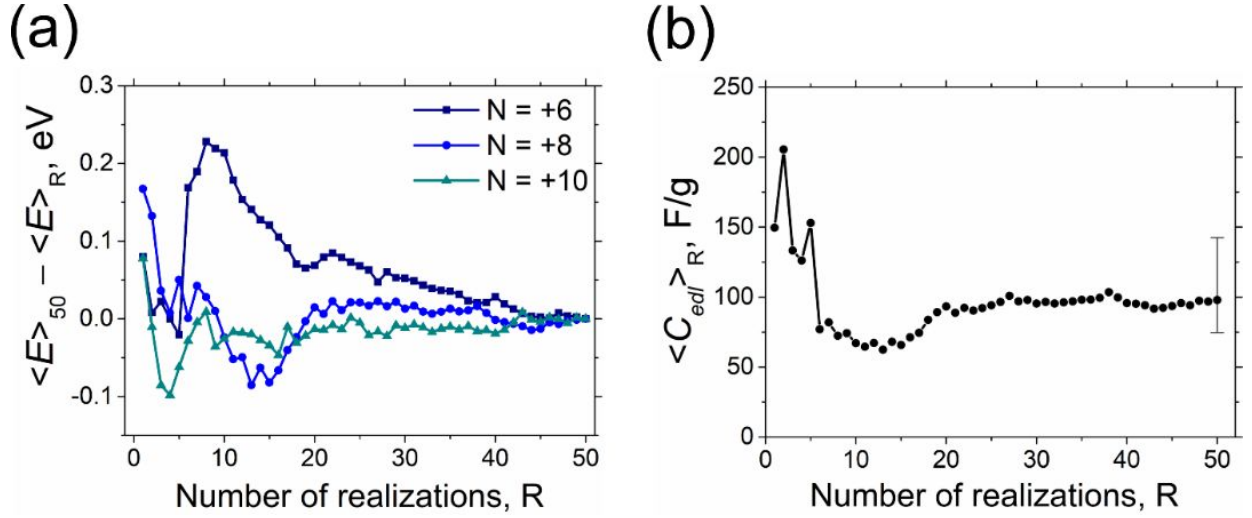


Figure S4 (a) — Dependence of the averaged total energies of PEDOT oligomer (24 monomers) charged with six, eight, or ten counterions on a number of different spatial positions of counterions. The dependence is depicted as a difference from the total energies, averaged over 50 realizations: $\langle \Delta E \rangle_{50} - \langle \Delta E \rangle_R$. (b) — the change of the averaged electrostatic capacitance $\langle C_{edl} \rangle_R$, depending on the number of different counterion realizations for a PEDOT oligomer. Because the total energy of PEDOT:TOS is dependent on the TOS positions, we calculated fifty different counterion realization for $q = +6, +8, +10$ charged PEDOT. The final value of C_{EDL} was obtained after 50 realizations.

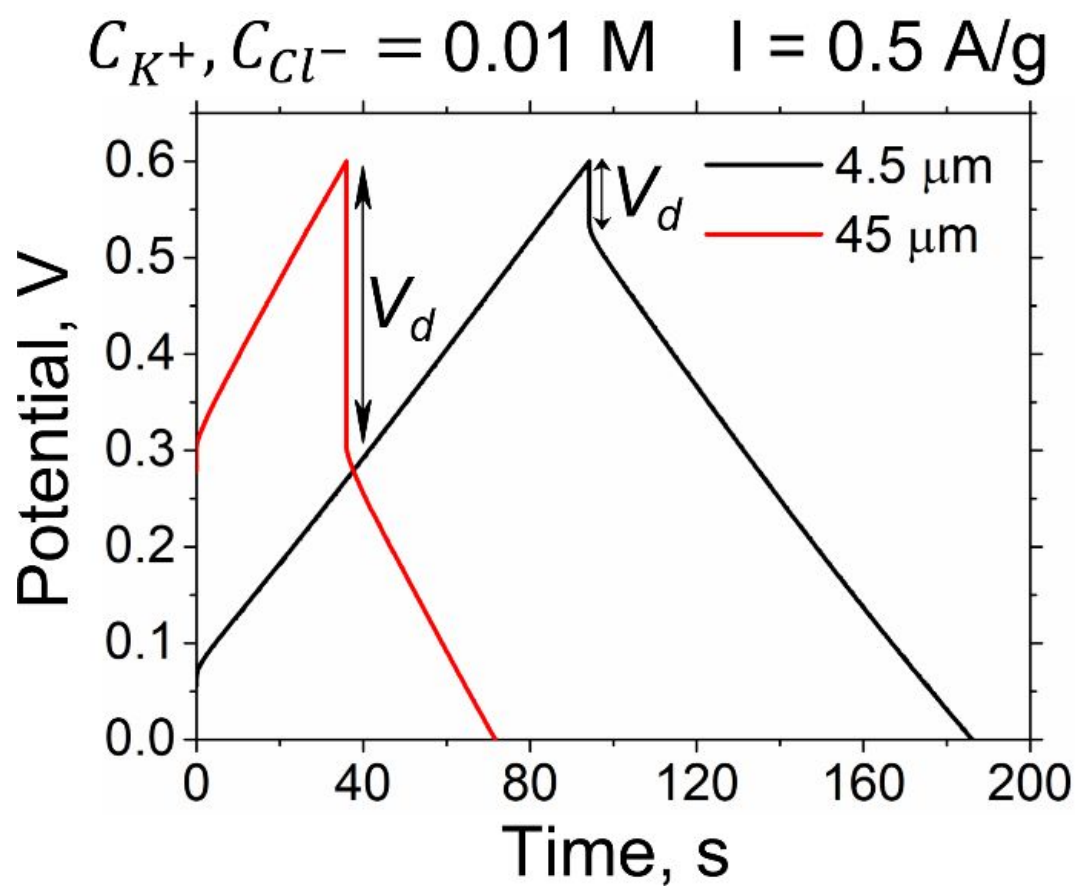


Figure S5. Voltage drop for thin (4.5 μm) and thick (45 μm) samples at the same current density 0.5 A/g.

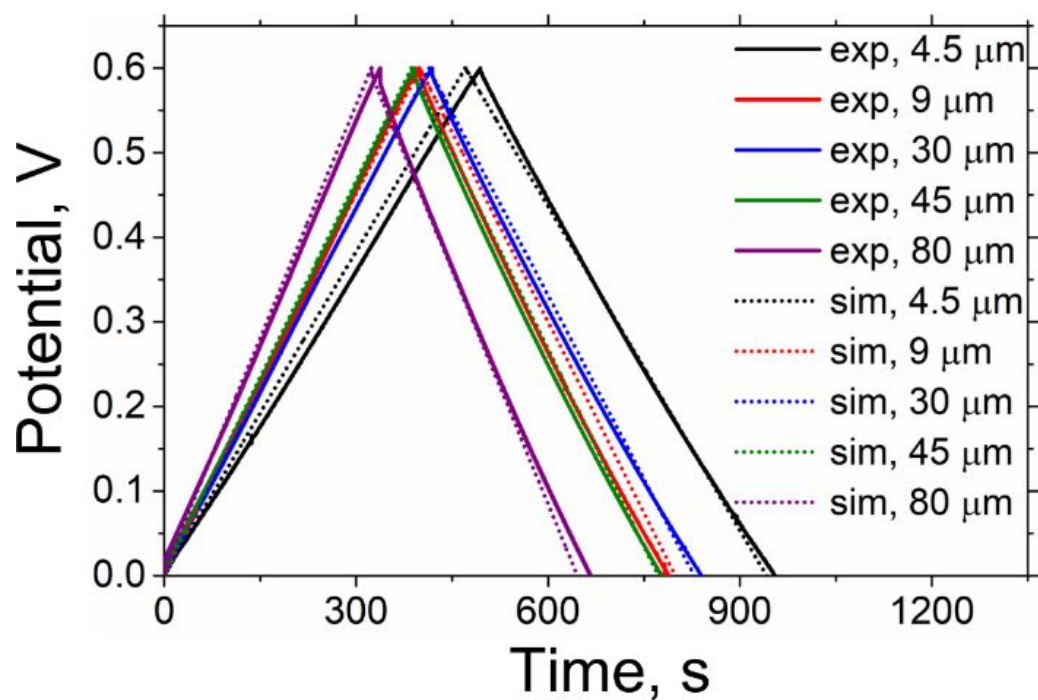


Figure S6. Experimental and simulated charge-discharge profiles for samples at all considered thicknesses and the same charging current 0.1 A/g. Due to the mass measurement errors, simulation curves were measured at slightly different currents, deviated in 10-15% from 0.1 A/g: 0.085 A/g for 4.5 μm , 0.1 A/g for 9 μm , 0.095 A/g for 30 μm , 0.1 A/g for 45 μm and 0.12 A/g for 80 μm samples. All studies were performed in 0.1 M KCl.

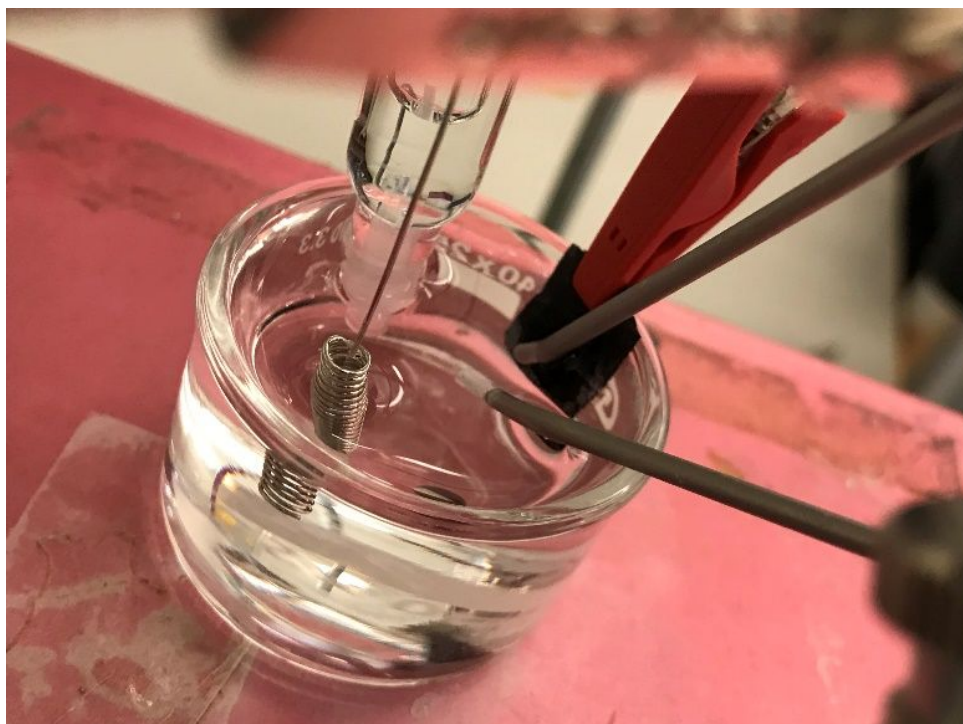


Figure S7. H_2O_2 and O_2 sensor (2 mm wide, WPI) assembly with GCD test cell.

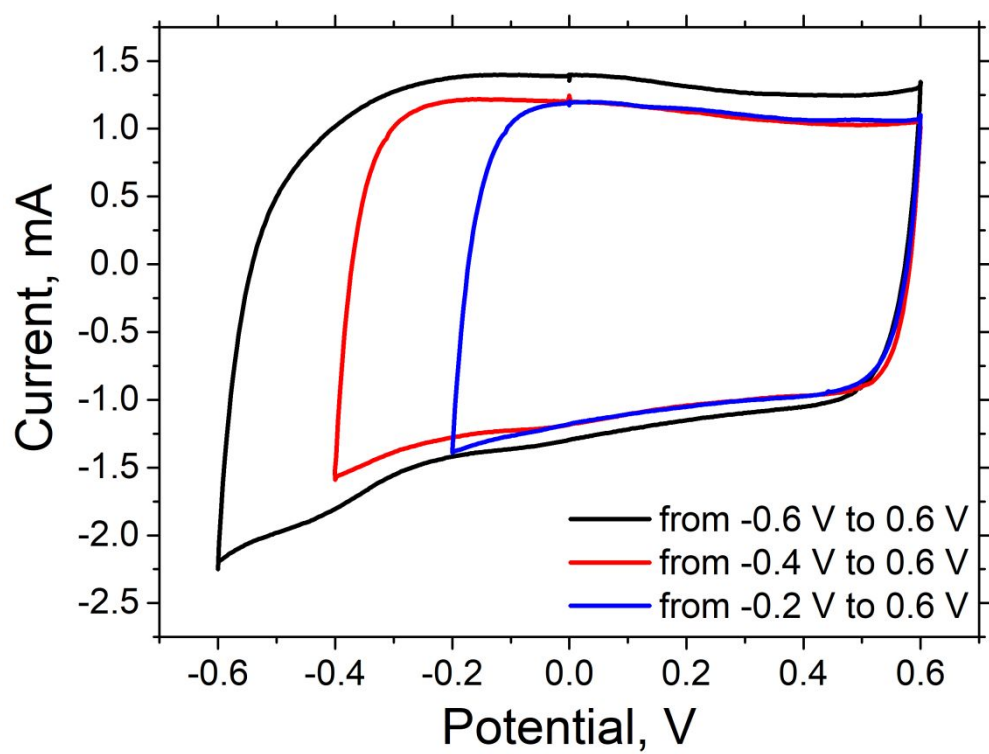


Figure S8. CV of the 9 μm power paper at 50 mV/s between negative and positive potentials.