Supporting Information for "Emitting electrode coatings with redox-switchable conductivity: Incorporation of ruthenium(II)-2,6-di(quinolin-8-yl)pyridine complexes into polythiophene by electropolymerization"

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Contents

Experimental Details

The preparation of [Ru(2,6-*bis*(4-(4-(thiophen-2-yl)phenyl)quinolin-8-yl)pyridine)(dqp)]-$(PF_6)_2$ (**1**) and [Ru(8,8'-(4-(4-(thiophen-2-yl)phenyl)pyridine-2,6-diyl)diquinoline)$_2$]$(PF_6)_2$ (**2**) was demonstrated elsewhere.[1] Thiophene was purchased from Aldrich.

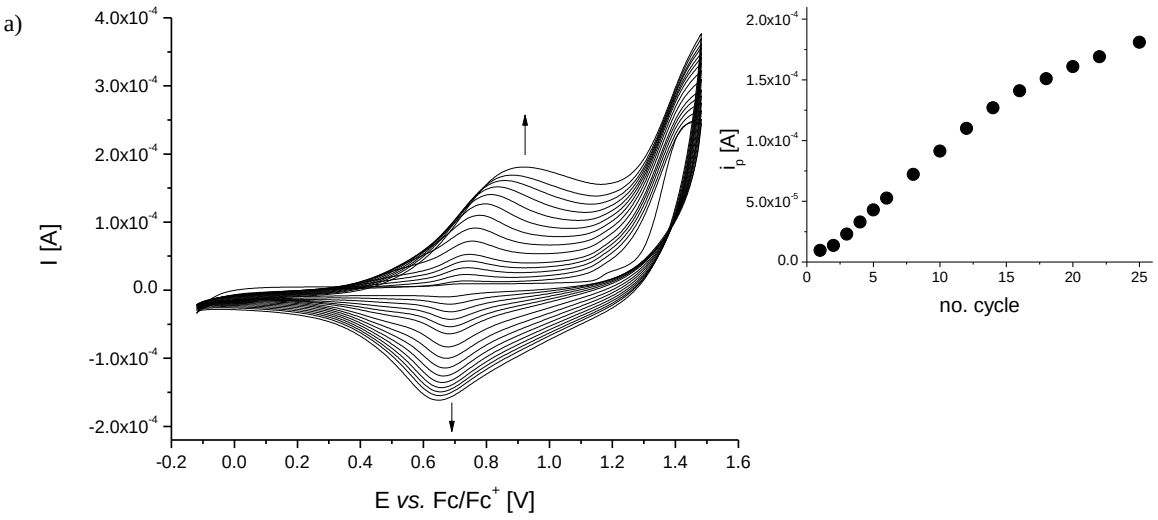
Electropolymerization and cyclic voltammetry (CV) experiments were performed on a Metrohm Autolab PGSTAT30 potentiostat with a standard three-electrode configuration using a platinum disk or an ITO-coated glass slide (Sigma Aldrich, ½ × 1″) as working electrode, a platinum-rod auxiliary electrode, and a Ag/AgCl reference electrode. The polymerization was carried out potentiodynamically applying velocities of 200 $mV \cdot s^{-1}$. The experiments were executed using concentrations of 10^{-4} M in deaerated acetonitrile (spectroscopy grade) containing 0.1 M Bu_4NPF_6 salt (dried previously by heating at 110 °C and storing under vacuum). At the end of each measurement, ferrocene was added as an internal standard.

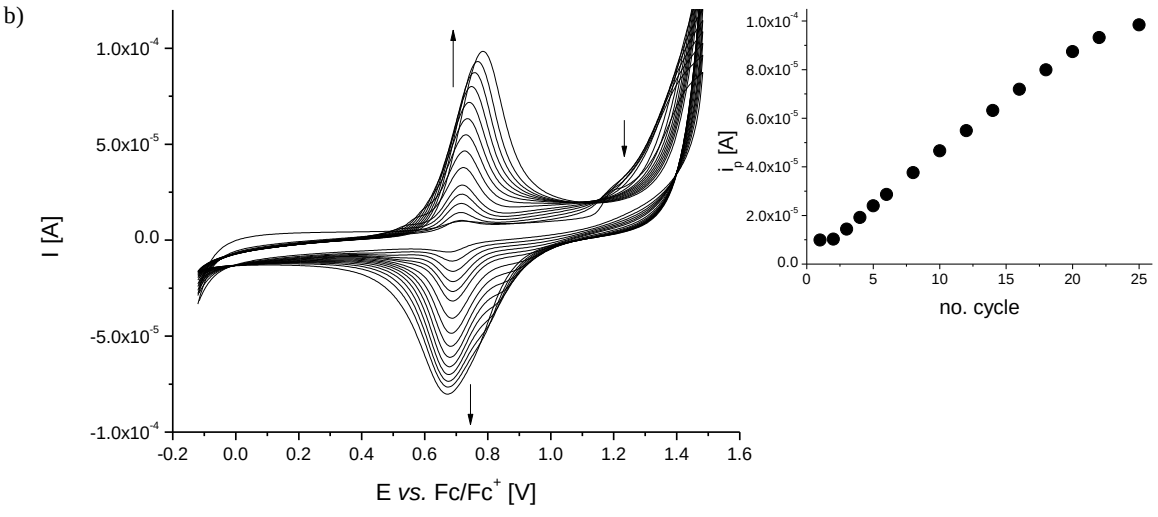
For electrochemical impedance spectroscopy (EIS), films were prepared onto platinum electrodes as described above and measured in dichloromethane containing 0.1 M Bu_4NPF_6 salt using a VersaStat MC potentiostat (Princeton Applied Research). The EIS experiments were executed applying different dc voltages on the one hand and ac frequencies of 10^6 to 5 Hz and ac voltage amplitude of 7 mV. Conductance values at different dc voltages were

determined using the respective Nyquist plot by fitting a semi-circle structure. With the help of an optical profilometer Wyko NT9100 (Veeco, Mannheim, Germany), film thicknesses could be estimated to calculate conductivity values.

UV-vis absorption spectra of polymer films deposited on ITO-coated glass were measured through the film on a Perkin-Elmer Lambda 750 UV/VIS spectrophotometer. Respective emission spectra were recorded on top of the film with a Tecan infinite M200 Pro microplate reader.

Electropolymerization Experiments





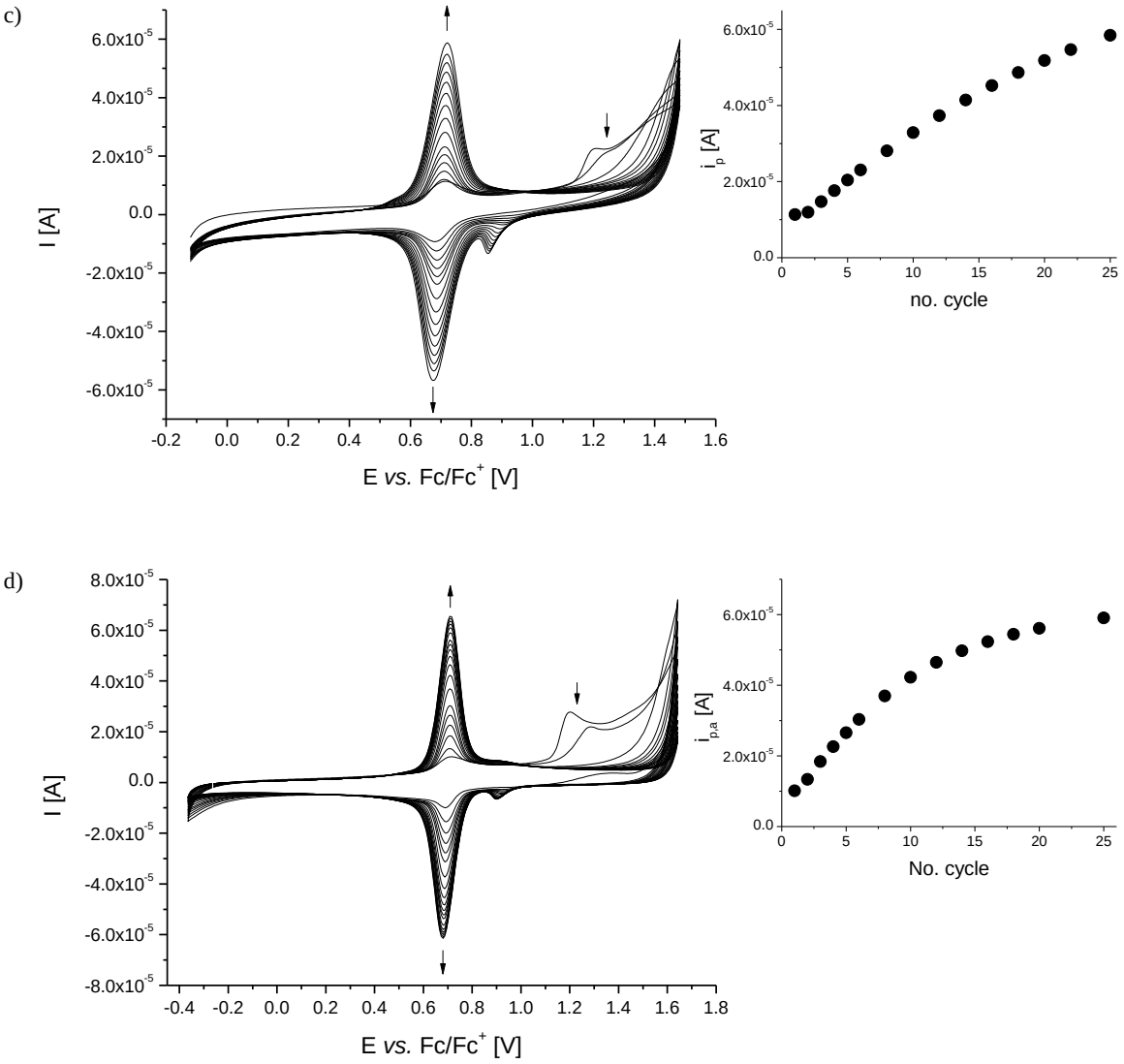
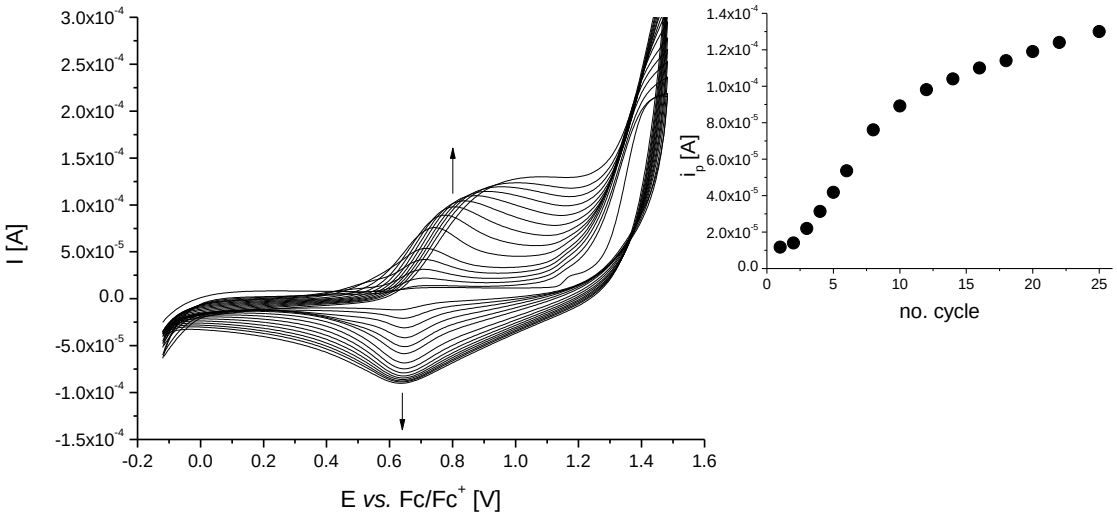
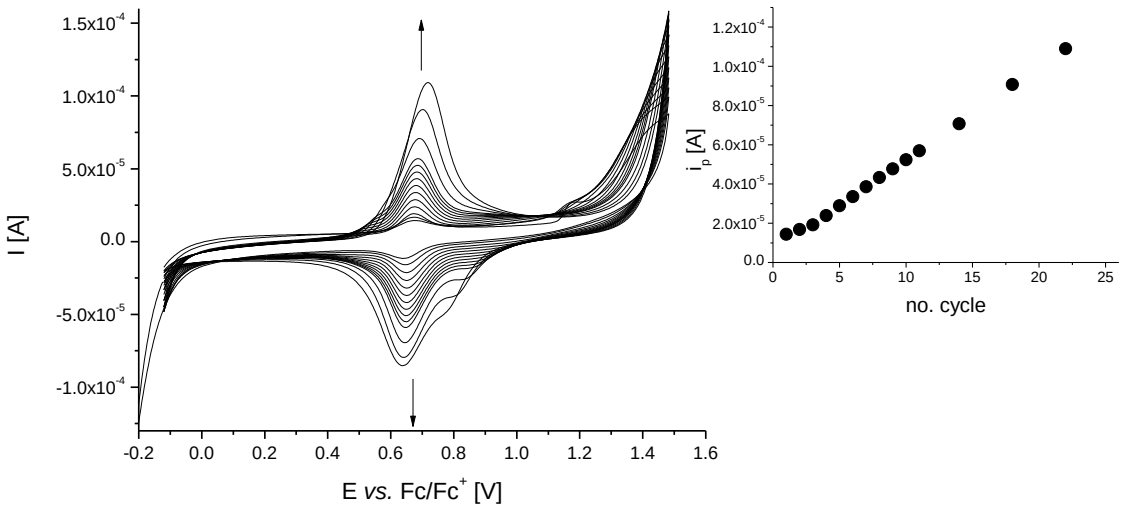


Figure S1. CV development during electro-*co*-polymerization complex **1** with thiophene (ratios of a) 1:20, b) 1:5, c) 1:1, and d) pure **1**).

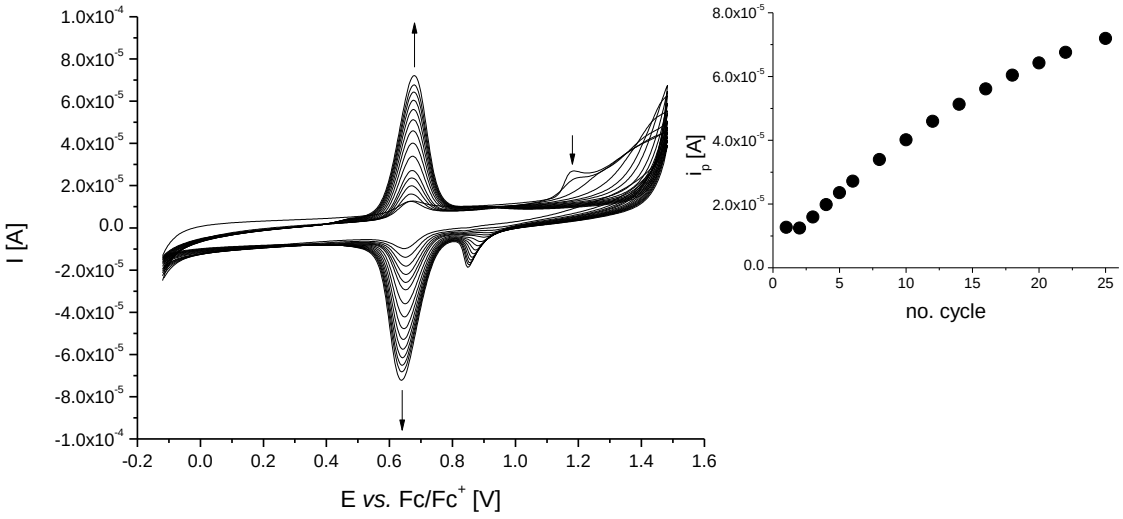
a)



b)



c)



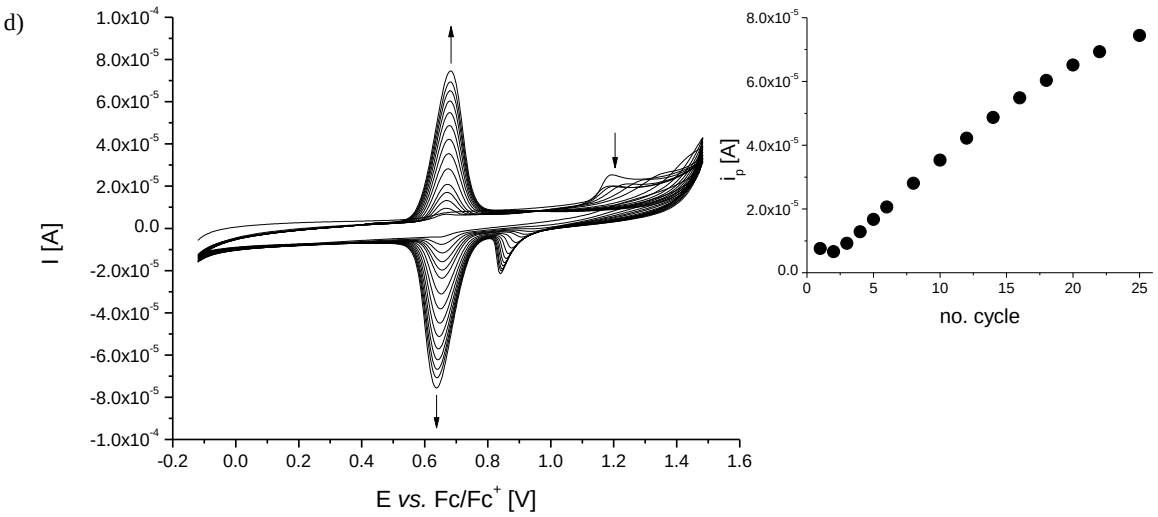


Figure S2. CV development during electro-*co*-polymerization complex **2** with thiophene (ratios of a) 1:20, b) 1:5, c) 1:1, and d) pure **2**).

Electrochemical Characterization

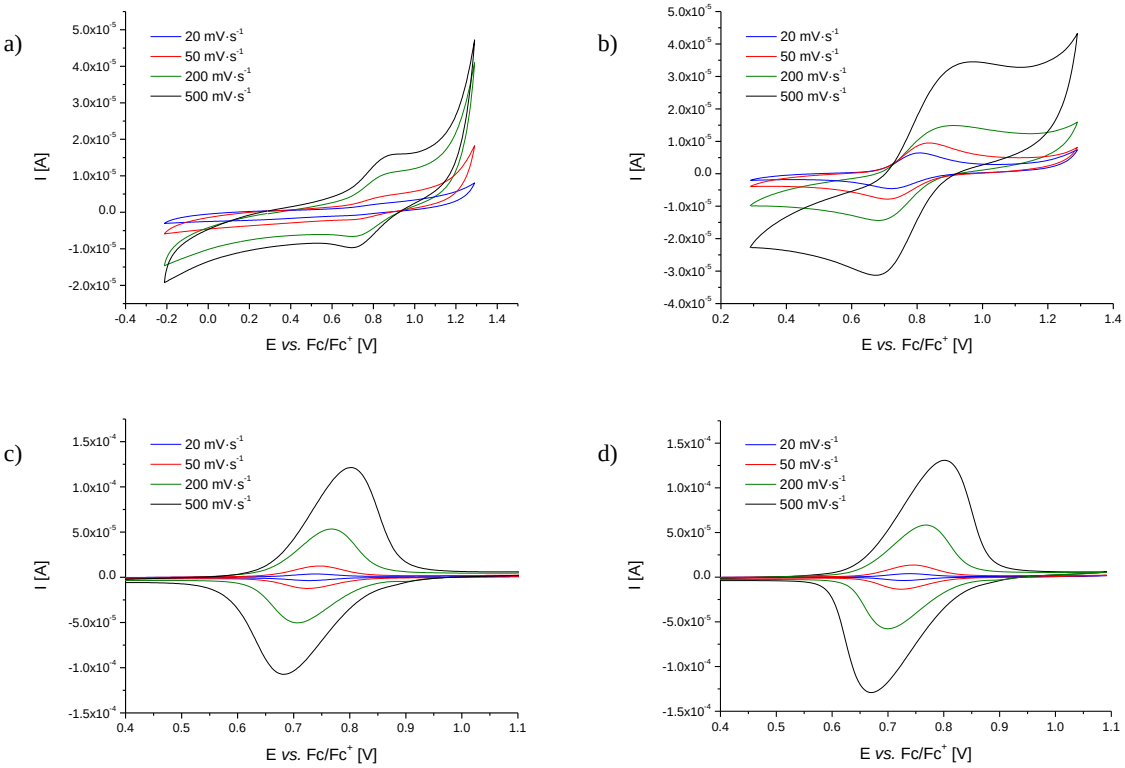


Figure S3. Cyclic voltammograms of films of a) poly(**1**)**a**, b) poly(**1**)**b**, c) poly(**1**)**c**, and d) poly(**1**)**d** on a platinum disk electrode at different scan rates.

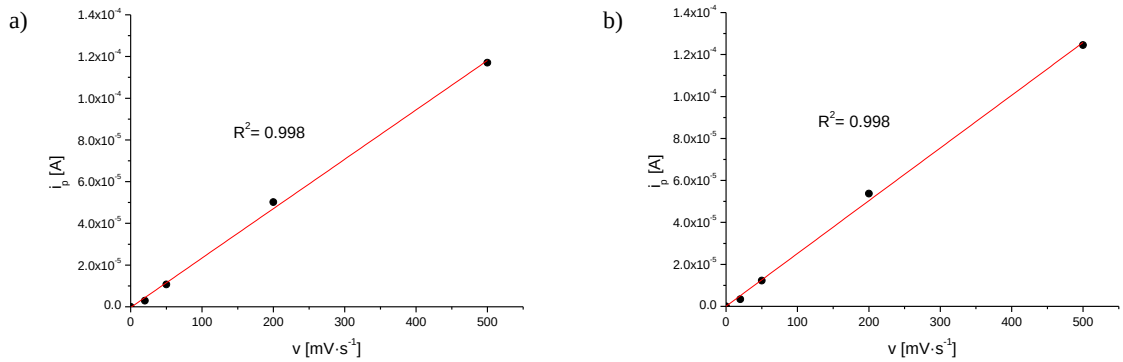


Figure S4. CV-peak-current dependence on the scan rate for a) poly(**1**)**c** and b) poly(**1**)**d** on a platinum disk electrode.

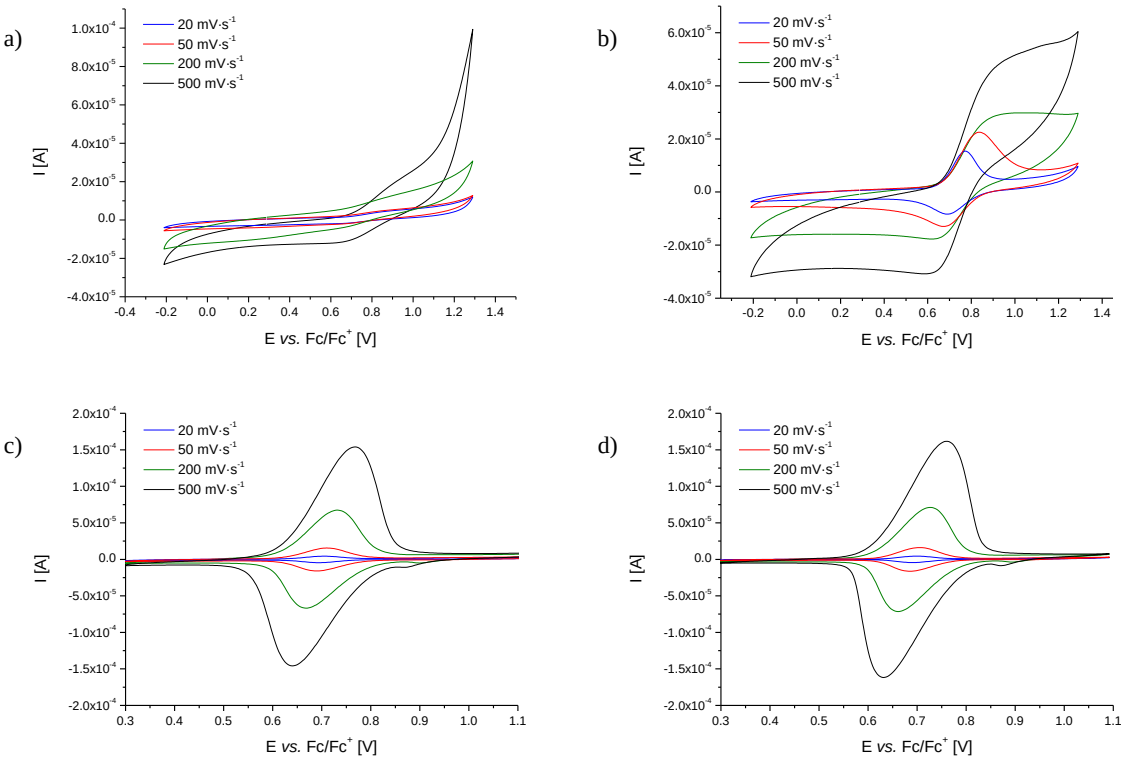


Figure S5. Cyclic voltammograms of films of a) poly(**2**)**a**, b) poly(**2**)**b**, c) poly(**2**)**c**, and d) poly(**2**)**d** on a platinum disk electrode at different scan rates.

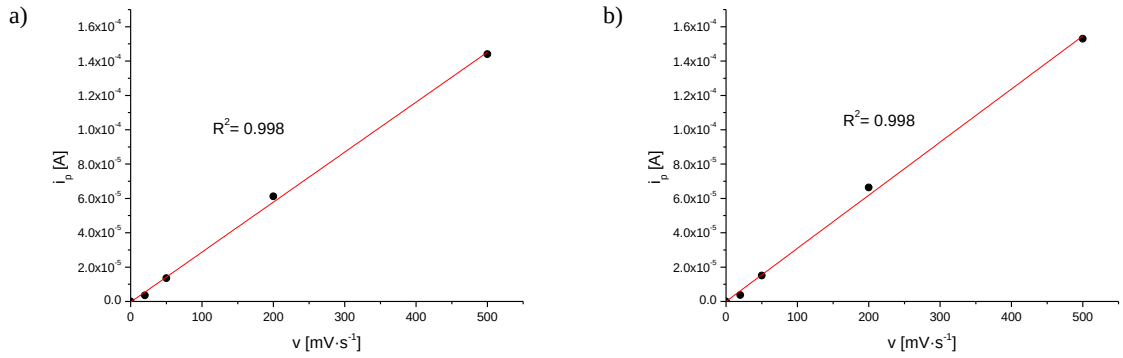


Figure S6. CV-peak-current dependence on the scan rate for a) poly(**2**)**c** and b) poly(**2**)**d** on a platinum disk electrode.

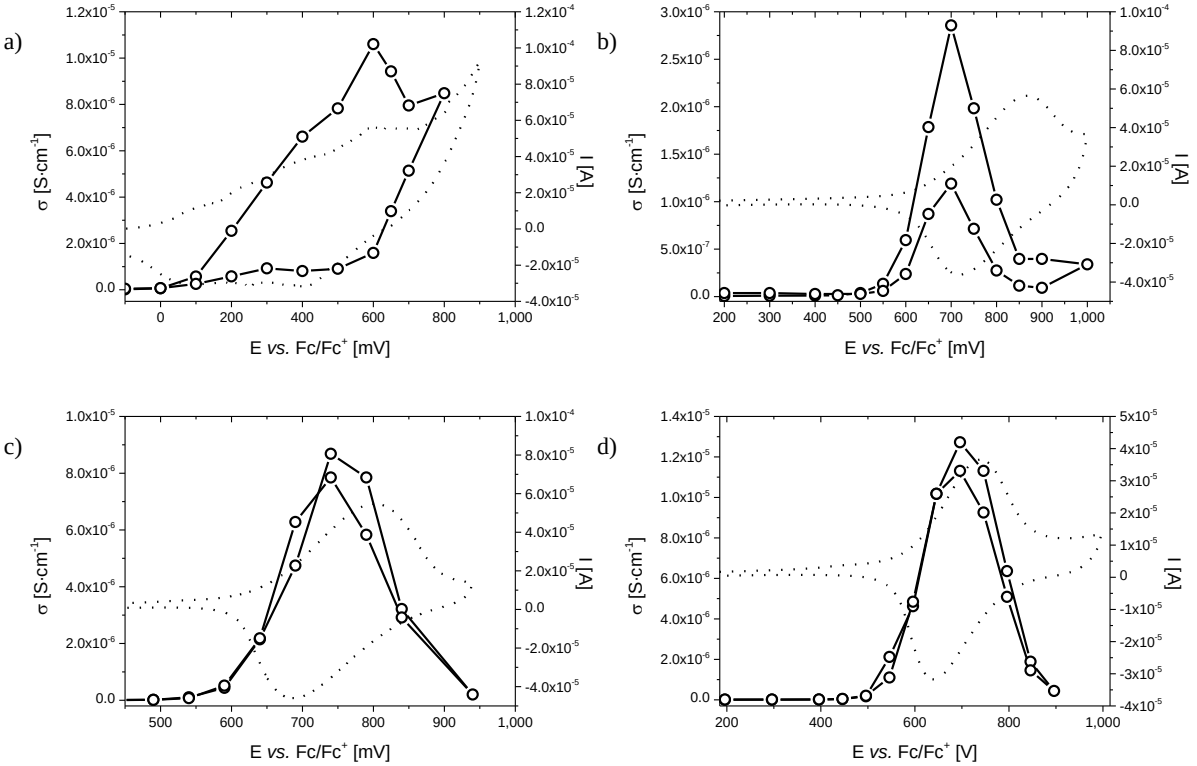


Figure S7. Conductivities of a) poly(**2**)**a**, b) poly(**2**)**b**, c) poly(**2**)**c**, and d) poly(**2**)**d** films on a platinum electrode depending on the applied potential (solid line; dotted line: respective CV).

Electrochemical Impedance Spectroscopy

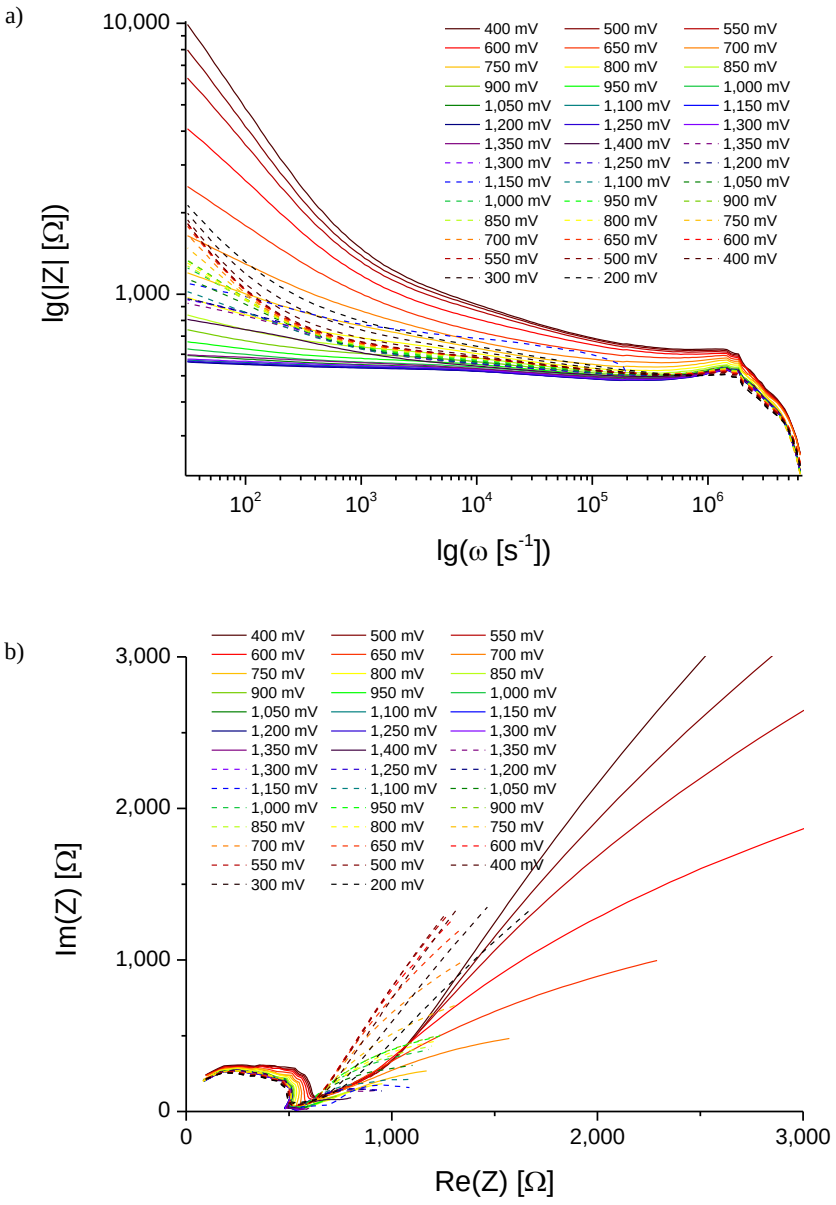


Figure S8. Bode (a) and Nyquist (b) plot of electrochemical impedance spectroscopy of poly(**1**)**a** (potentials *vs.* Ag/Ag^+, according to +400 mV *vs.* Fc/Fc^+; solid lines: increasing potential, dashed lines: decreasing potential).

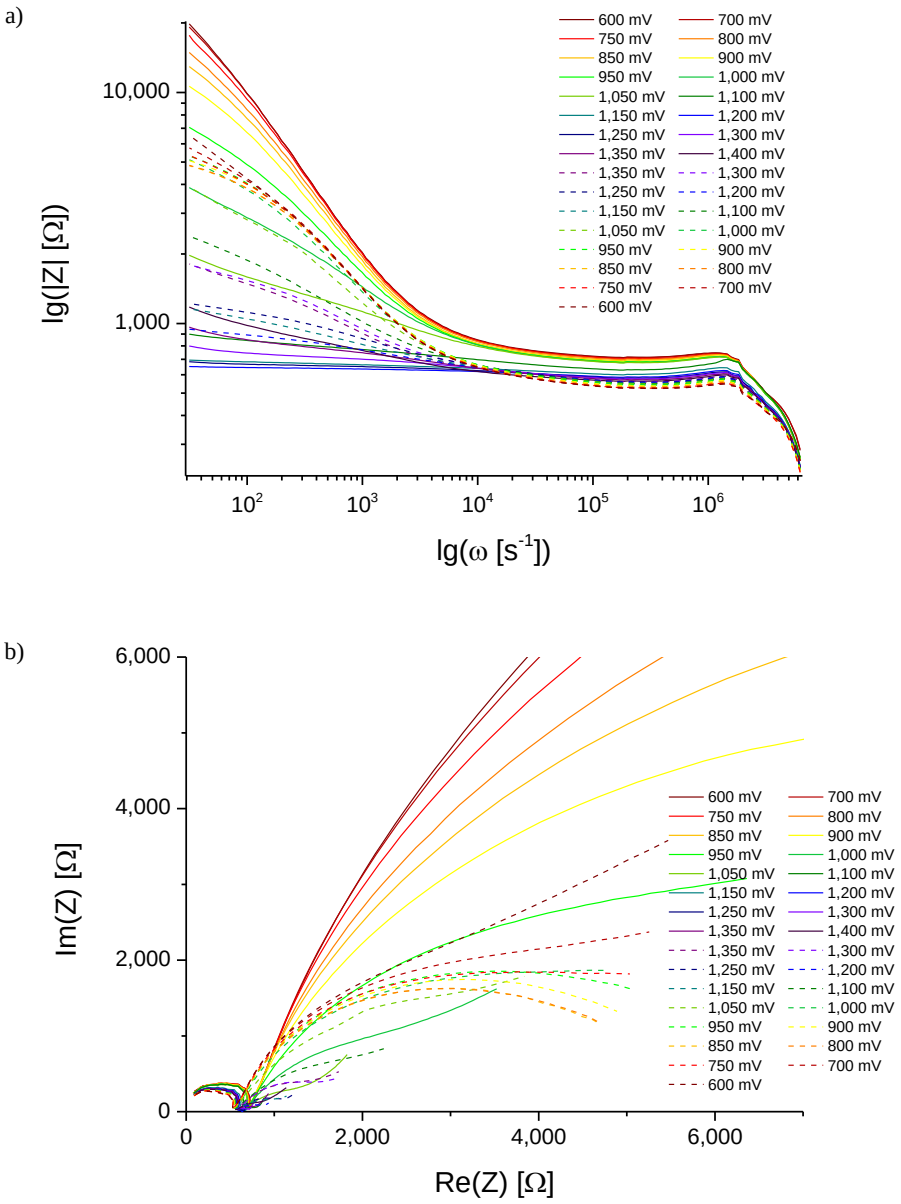


Figure S9. Bode (a) and Nyquist (b) plot of electrochemical impedance spectroscopy of poly(**1**)**b** (potentials *vs.* Ag/Ag^+, according to +400 mV *vs.* Fc/Fc^+; solid lines: increasing potential, dashed lines: decreasing potential).

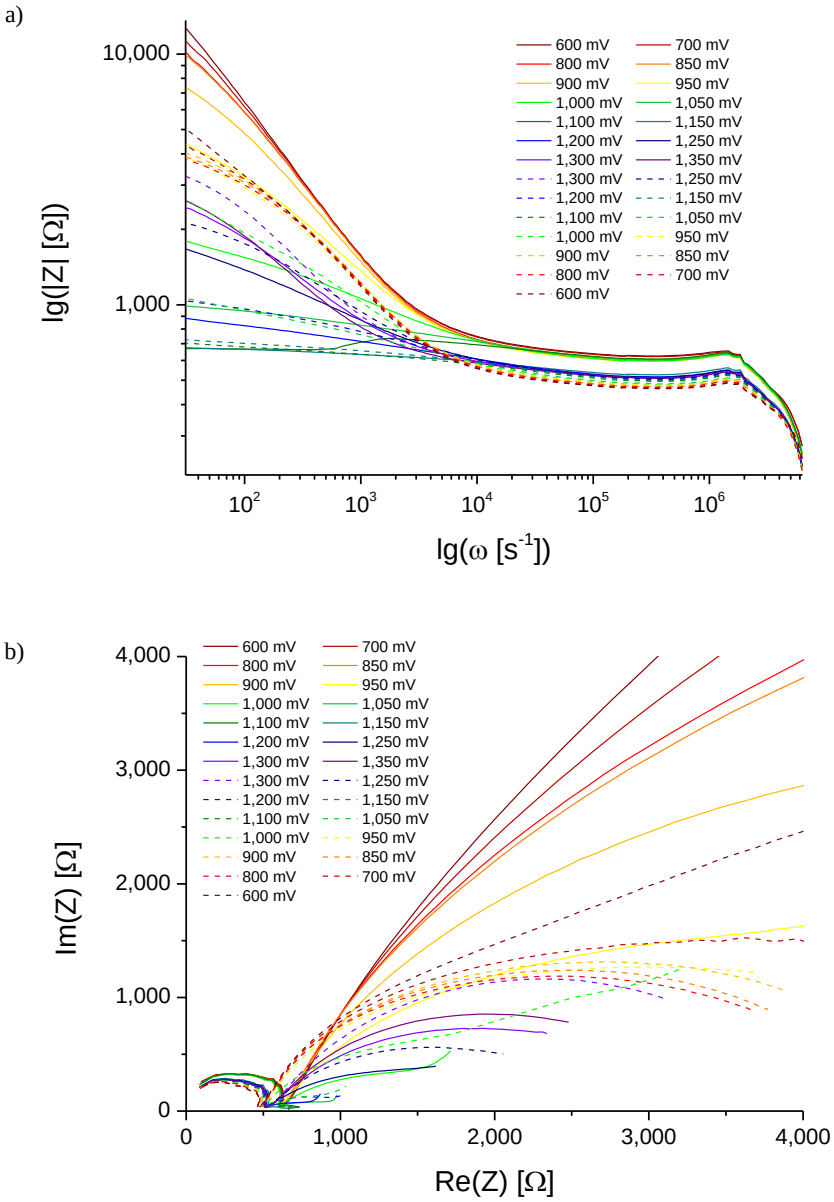


Figure S10. Bode (a) and Nyquist (b) plot of electrochemical impedance spectroscopy of poly(**1**)**c** (potentials *vs.* Ag/Ag^+, according to +400 mV *vs.* Fc/Fc^+; solid lines: increasing potential, dashed lines: decreasing potential).

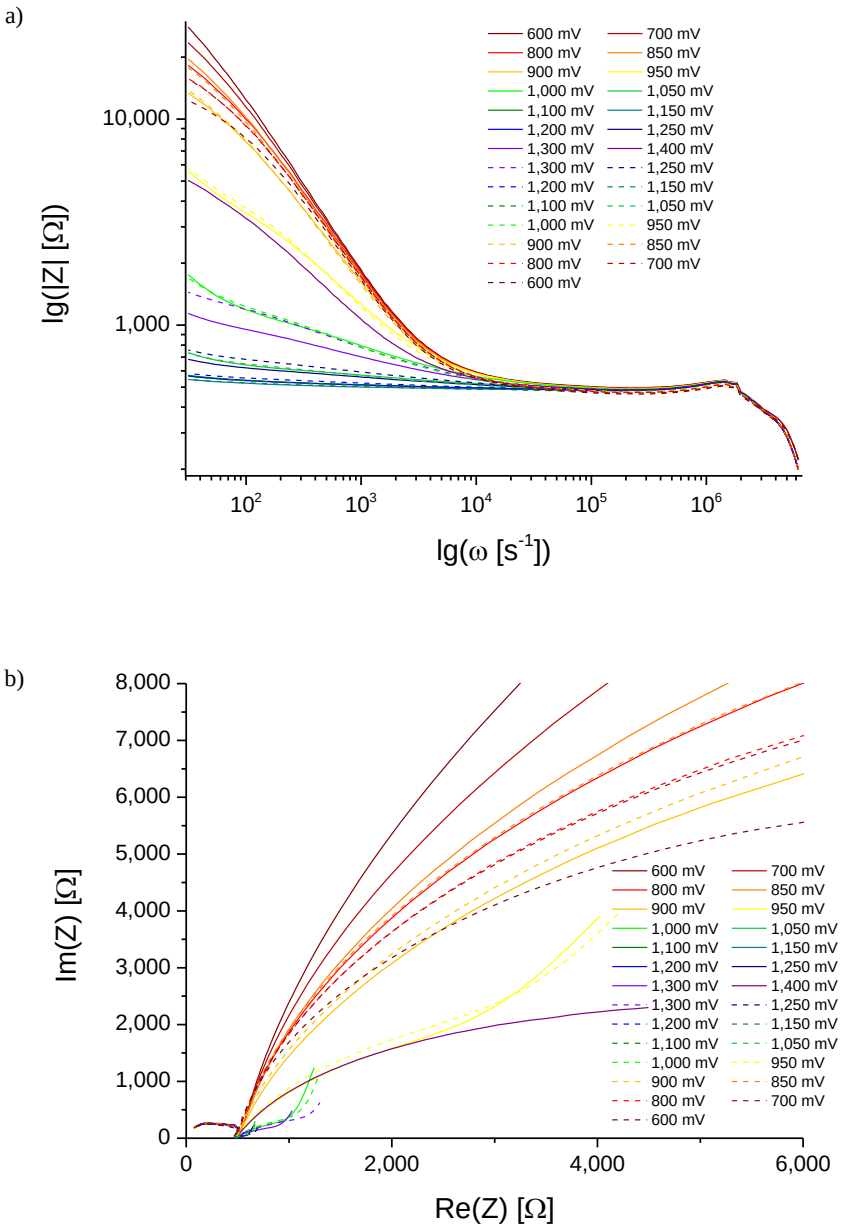


Figure S11. Bode (a) and Nyquist (b) plot of electrochemical impedance spectroscopy of poly(**1**)**d** (potentials *vs.* Ag/Ag^+, according to +400 mV *vs.* Fc/Fc^+; solid lines: increasing potential, dashed lines: decreasing potential).

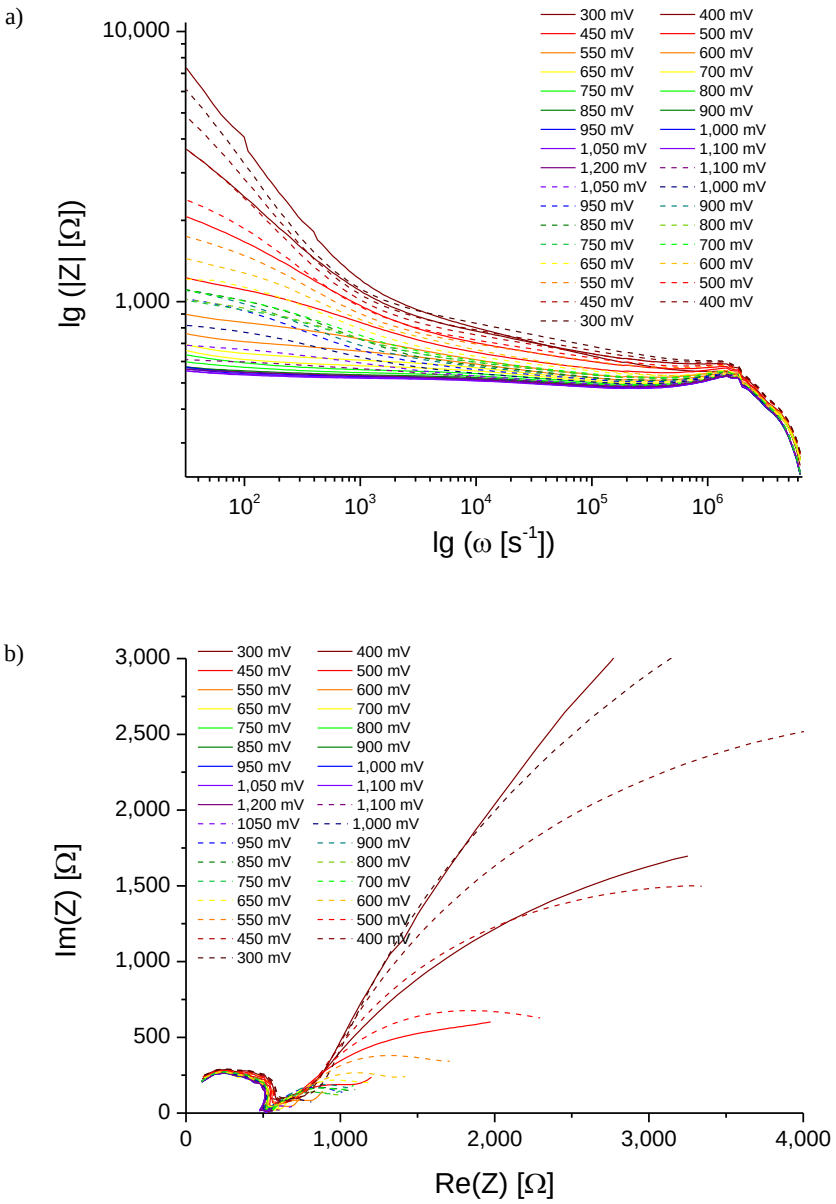


Figure S12. Bode (a) and Nyquist (b) plot of electrochemical impedance spectroscopy of poly(**2**)**a** (potentials *vs.* Ag/Ag^+, according to +400 mV *vs.* Fc/Fc^+; solid lines: increasing potential, dashed lines: decreasing potential).

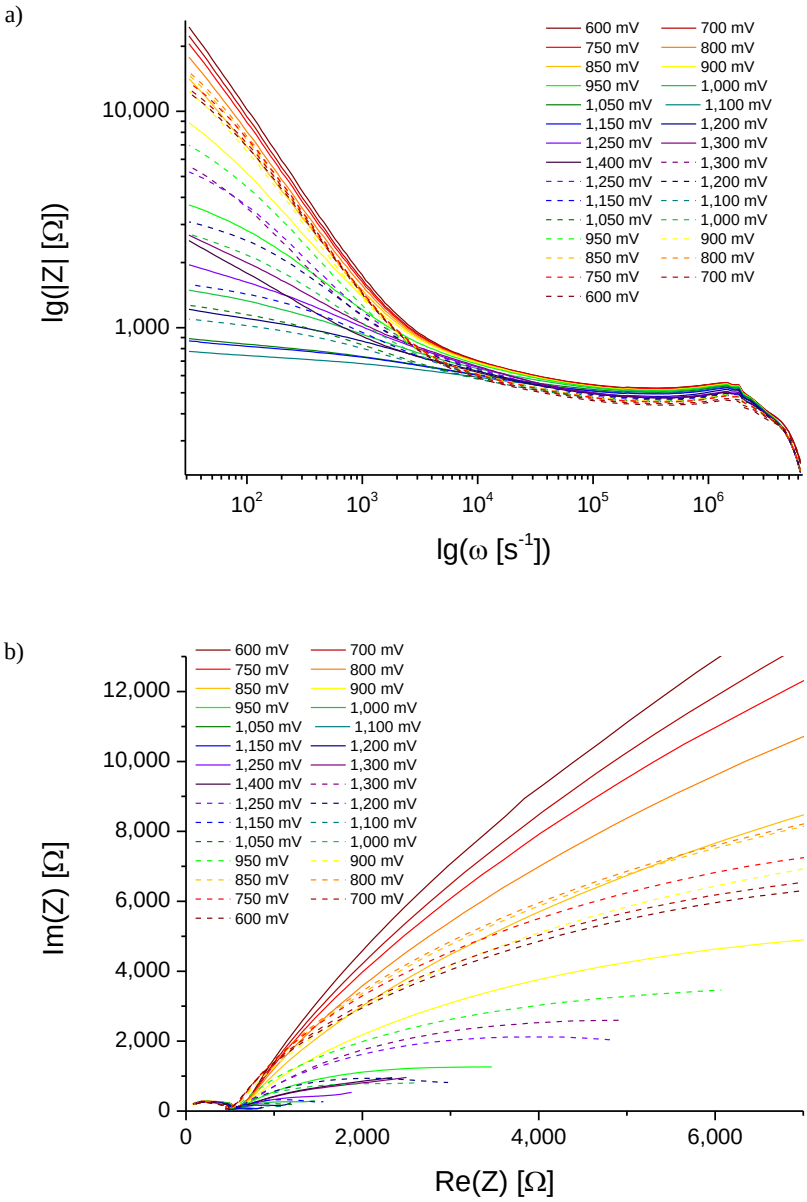


Figure S13. Bode (a) and Nyquist (b) plot of electrochemical impedance spectroscopy of poly(**2**)**b** (potentials *vs.* Ag/Ag^+, according to +400 mV *vs.* Fc/Fc^+; solid lines: increasing potential, dashed lines: decreasing potential).

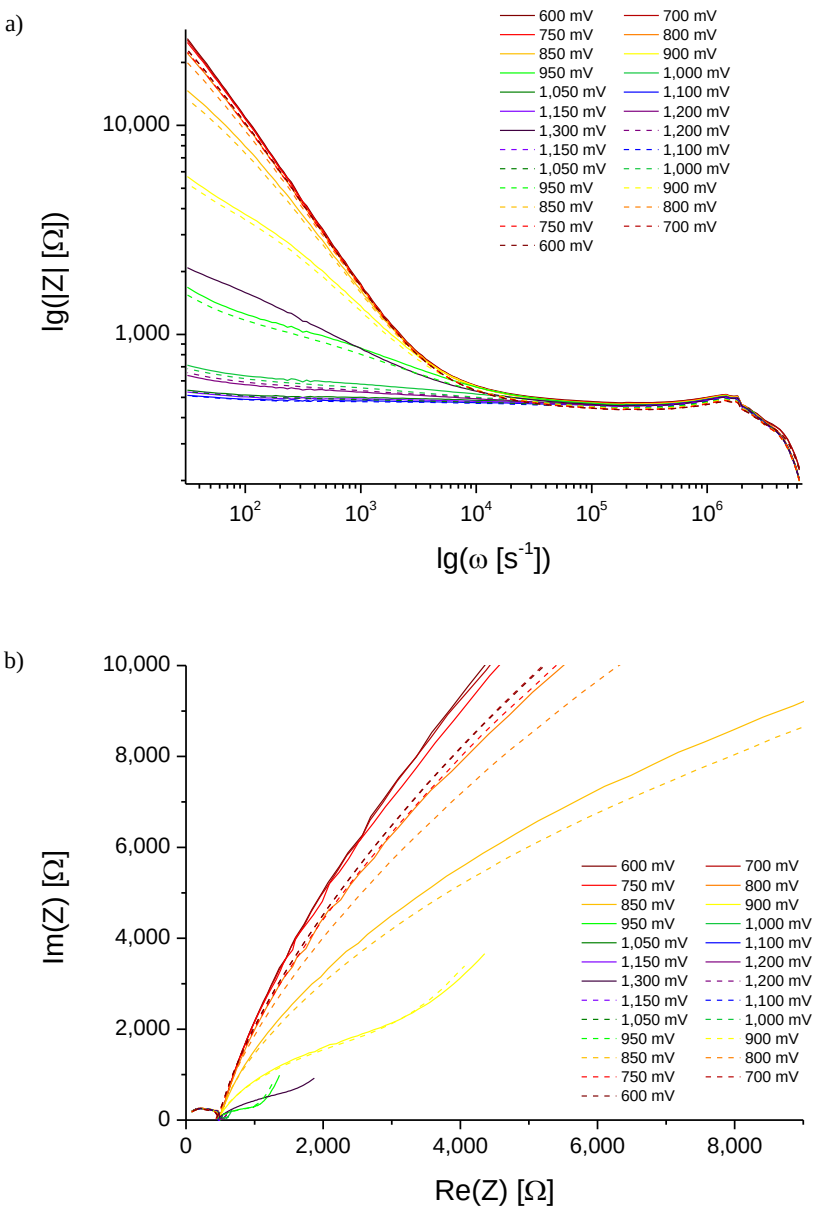


Figure S14. Bode (a) and Nyquist (b) plot of electrochemical impedance spectroscopy of poly(**2**)**c** (potentials *vs.* Ag/Ag^+, according to +400 mV *vs.* Fc/Fc^+; solid lines: increasing potential, dashed lines: decreasing potential).

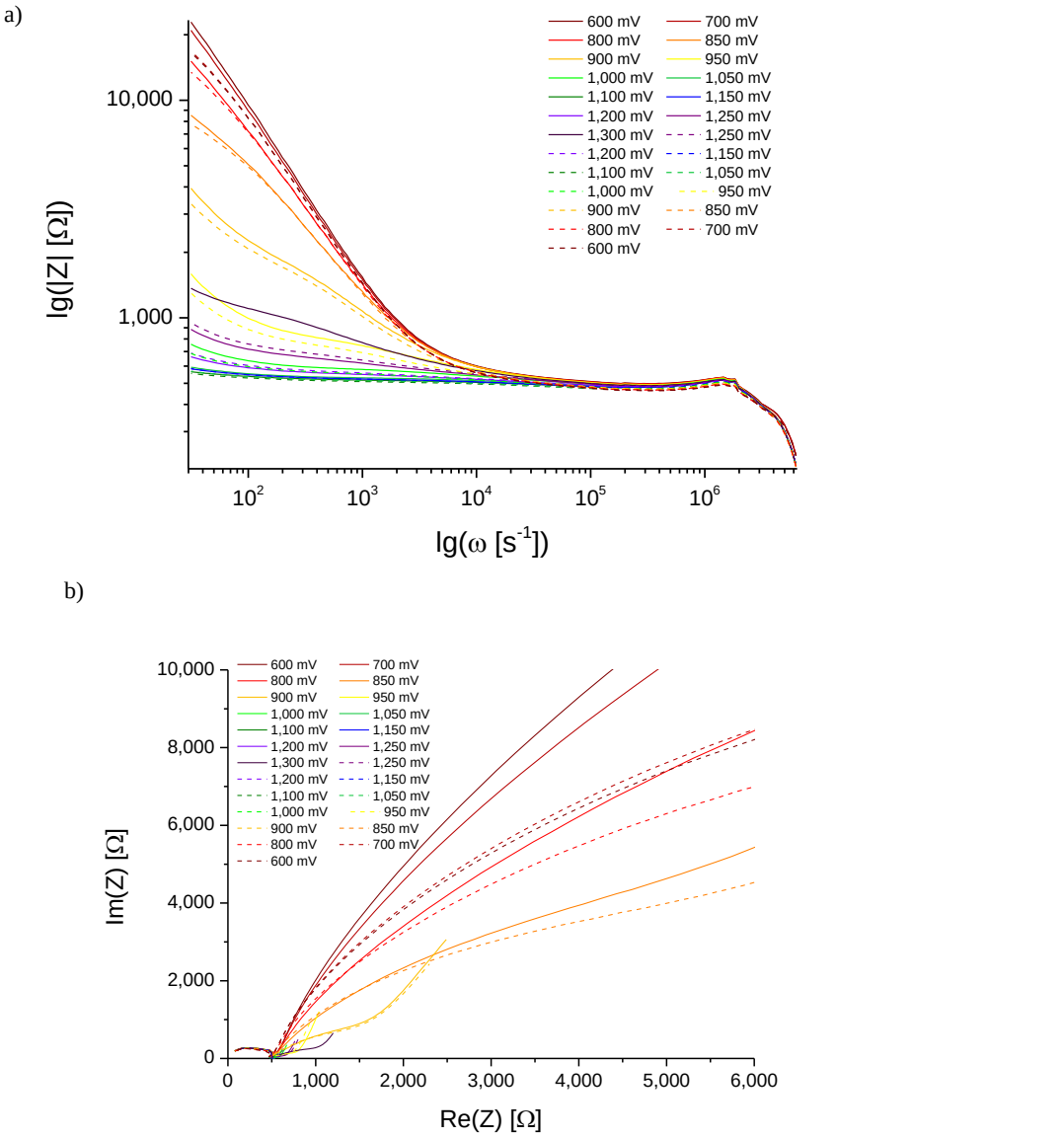


Figure S15. Bode (a) and Nyquist (b) plot of electrochemical impedance spectroscopy of poly(**2**)**d** (potentials *vs.* Ag/Ag^+, according to +400 mV *vs.* Fc/Fc^+; solid lines: increasing potential, dashed lines: decreasing potential).

Optical Characterization

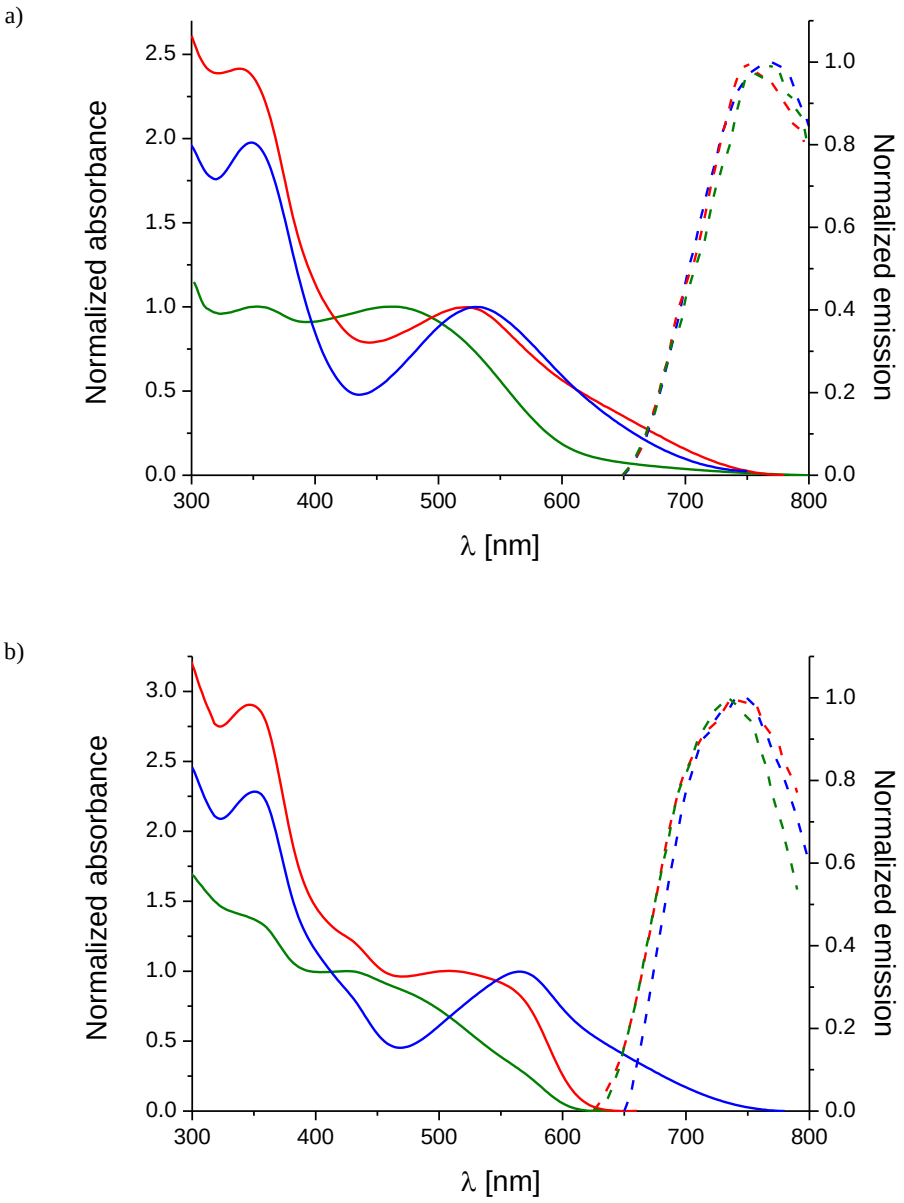


Figure S16. UV-vis absorption (solid lines) and emission (dashed lines) spectra of *co*-polymers of a) **1** and b) **2** with different complex-thiophene ratios (blue: *homo*-polymer, red: 1:5, green: 1:20) on ITO-coated glass.

1 C. Friebe, H. Görls, M. Jäger, U. S. Schubert, Manuscript in Preparation.