

Electronic Supplementary Material (ESI) for Polymer Chemistry. This journal is © of The Royal Society of Chemistry 2014

Supporting information

Polymer/Zinc Hybrid-Flow Battery Using Block Copolymer Micelles featuring a TEMPO Corona As Catholyte

Jan Winsberg,^{ab} Simon Muench,^{ab} Tino Hagemann,^{ab} Sabine Morgenstern,^{ab} Tobias Janoschka,^{ab} Mark Billing,^a Felix H. Schacher,^{ab} Guillaume Hauffman,^c Jean-François Gohy,^c Stephanie Hoepfner,^a Martin D. Hager,^{ab} Ulrich S. Schubert^{ab *}

a Laboratory of Organic and Macromolecular Chemistry (IOMC), Friedrich Schiller University Jena, Humboldtstraße 10, 07743 Jena, Germany ulrich.schubert@uni-jena.de

b Center for Energy and Environmental Chemistry Jena (CEEC Jena), Friedrich Schiller University Jena, Philosophenweg 7a, 07743 Jena, Germany

c Institute of Condensed Matter and Nanoscience, Bio- and Soft Matter, Université catholique de Louvain, Louvain-la-Neuve, 1348 Belgium.

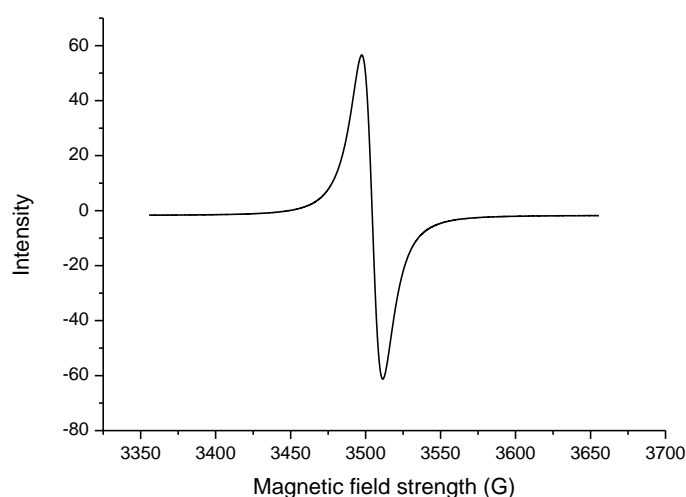


Figure S1: Electron paramagnetic resonance (EPR) measurement of PTMA₆₃-*b*-PS₃₅ in the solid state, spin count: 1.657×10¹⁸ spins mg⁻¹.

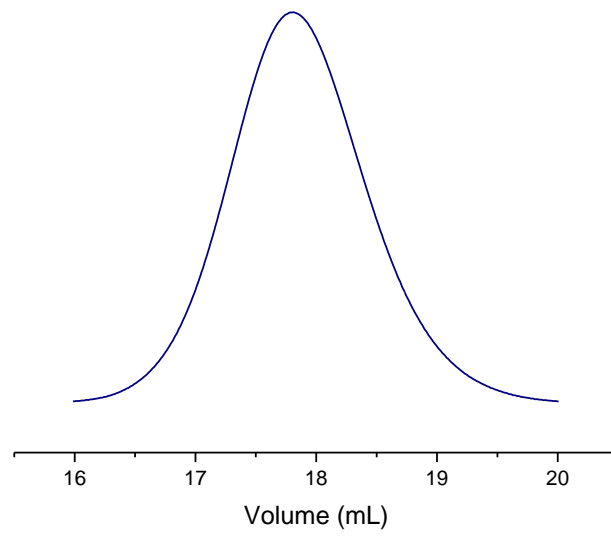


Figure S2: Size exclusion chromatography (SEC) elugram of PTMA₆₃-*b*-PS₃₅, eluent: DMAc + 0.21 wt-% LiCl, poly(styrene) standard.

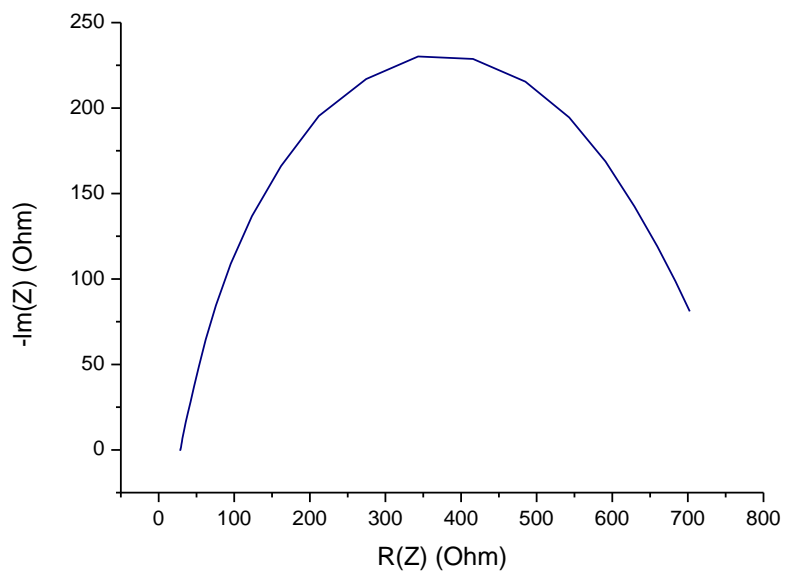
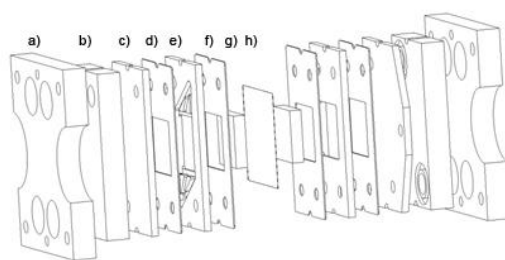


Figure S3: Electrochemical impedance spectroscopy (EIS) of a polymer TEMPO/zinc hybrid-flow battery (pHFB) between 100 mHz and 200 kHz at 0 V in potentiostatic mode.



Scheme S1: Schematic representation of the electrochemical cell. One half-cell consists of a frame (a), PTFE block with hose connections and rubber seal (b), graphite or zinc current collector (c), rubber sealing (d), PTFE flow frame (e), rubber sealing (f) and a surface enhancing graphite felt/carbon paper (g). Both half cells are separated by a size exclusion membrane (h).

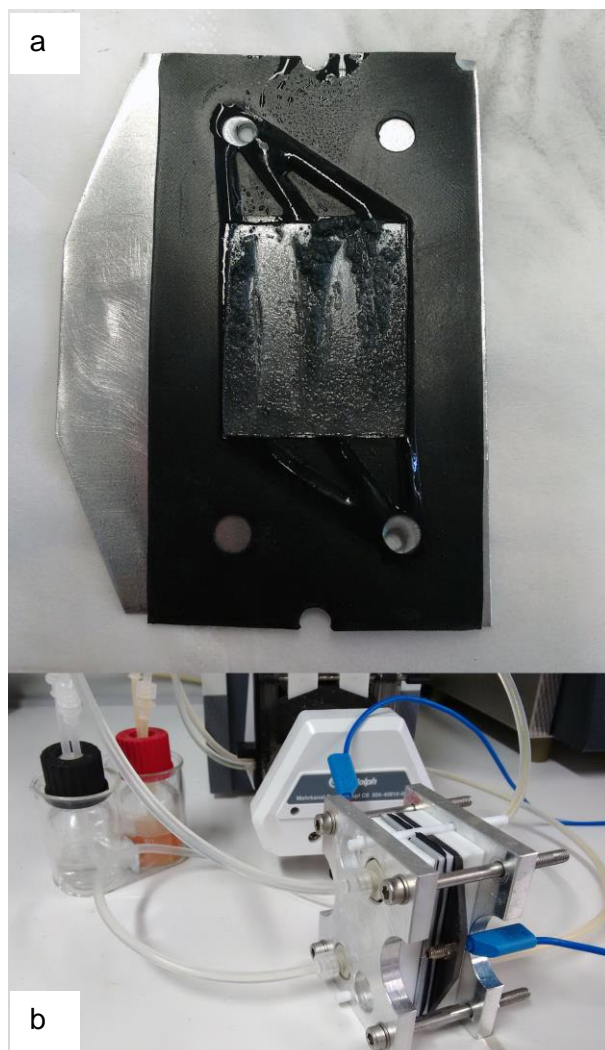


Figure S4: a) Dendrite formation inside the anode half-cell after battery cycling and b) pumped pHFB setup, comprising the electrochemical cell, two reservoir tanks (catholyte & anolyte) and a peristaltic pump.

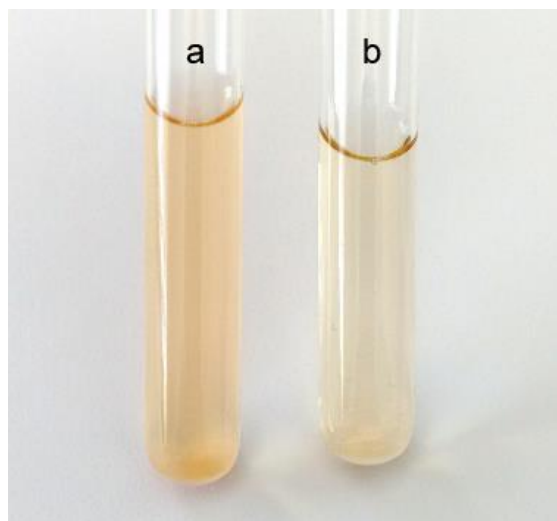


Figure S5: Micellar catholyte a) prior to charging (cloudy dispersion) and b) after charging (clear solution).

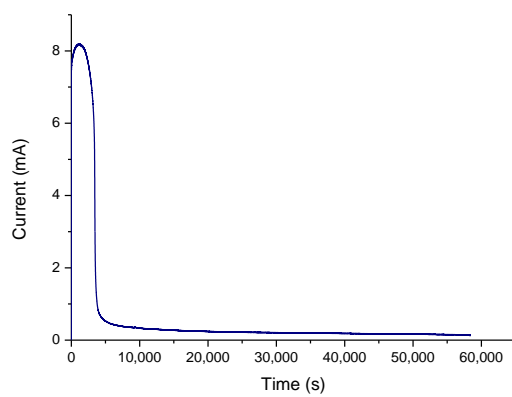


Figure S6: Chronoamperometry for charging of the pHFB, potential 1.9 V. The resulting current was measured over time.

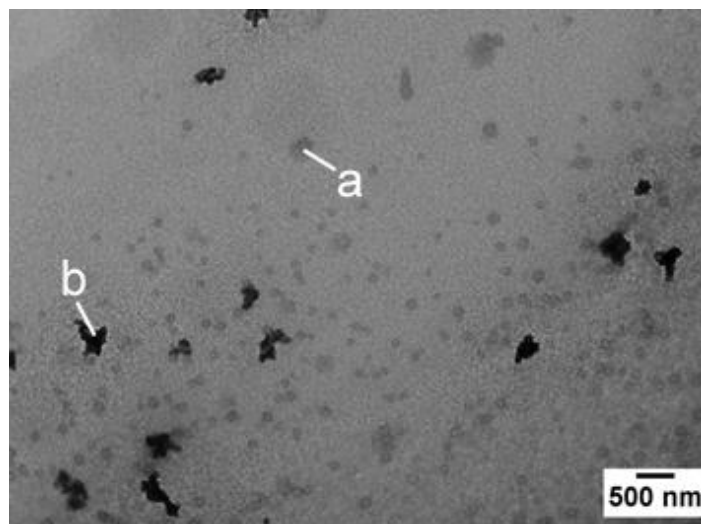


Figure S7: Transmission electron microscopy (TEM) image of PTMA₆₃-*b*-PS₃₅ after charging, catholyte: 13 mg mL⁻¹ active polymer in EC/DMC/DEC (*v:v:v* 1:1:1) with 0.5 M Zn(ClO₄)₂·6H₂O; secondary agglomerate ~300 nm diameter (a), high contrast agglomerate with an elevated content of heavy metal supporting electrolyte (b).

Table S1: Ion conductivity of the applied electrolyte.

Electrolyte	Ion conductivity [mS cm ⁻¹]
0.5 M Zn(ClO ₄) ₂ ·6H ₂ O	5.9