

## Supplementary Information

### Using Polymeric Ionic Liquids as an active binder in supercapacitors

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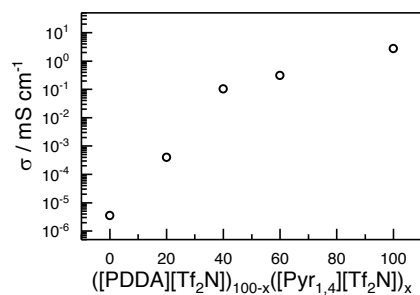


Figure S1. Ionic conductivity of drop-cast films containing [PDDA][Tf<sub>2</sub>N] and [Pyr<sub>1,4</sub>][Tf<sub>2</sub>N].

Measured with four-point probe. Pure IL ionic conductivity was measured using Electrochemical Impedance Spectroscopy with two parallel Pt electrodes.

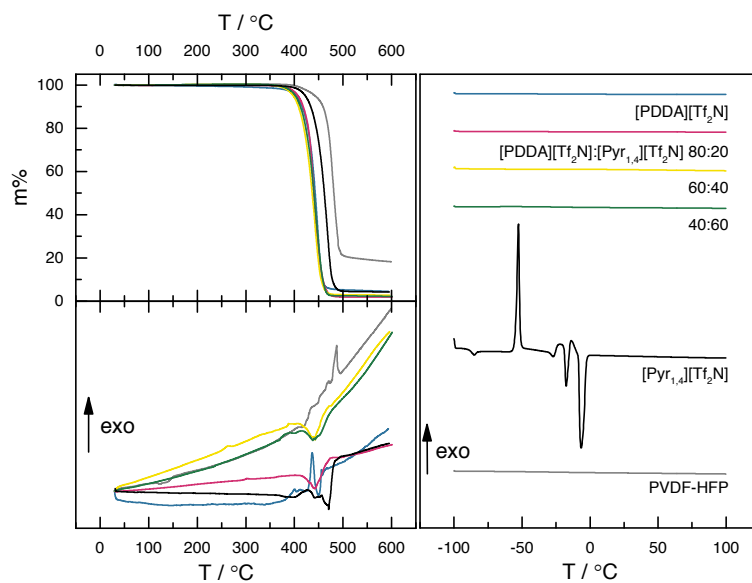


Figure S2. (a) mass loss, (b) heat flow during decomposition and (c) differential scanning calorimeter of [PDDA][Tf<sub>2</sub>N] and its mixtures with IL, the neat IL<sup>4</sup> and the co-polymer PVDF-HFP.

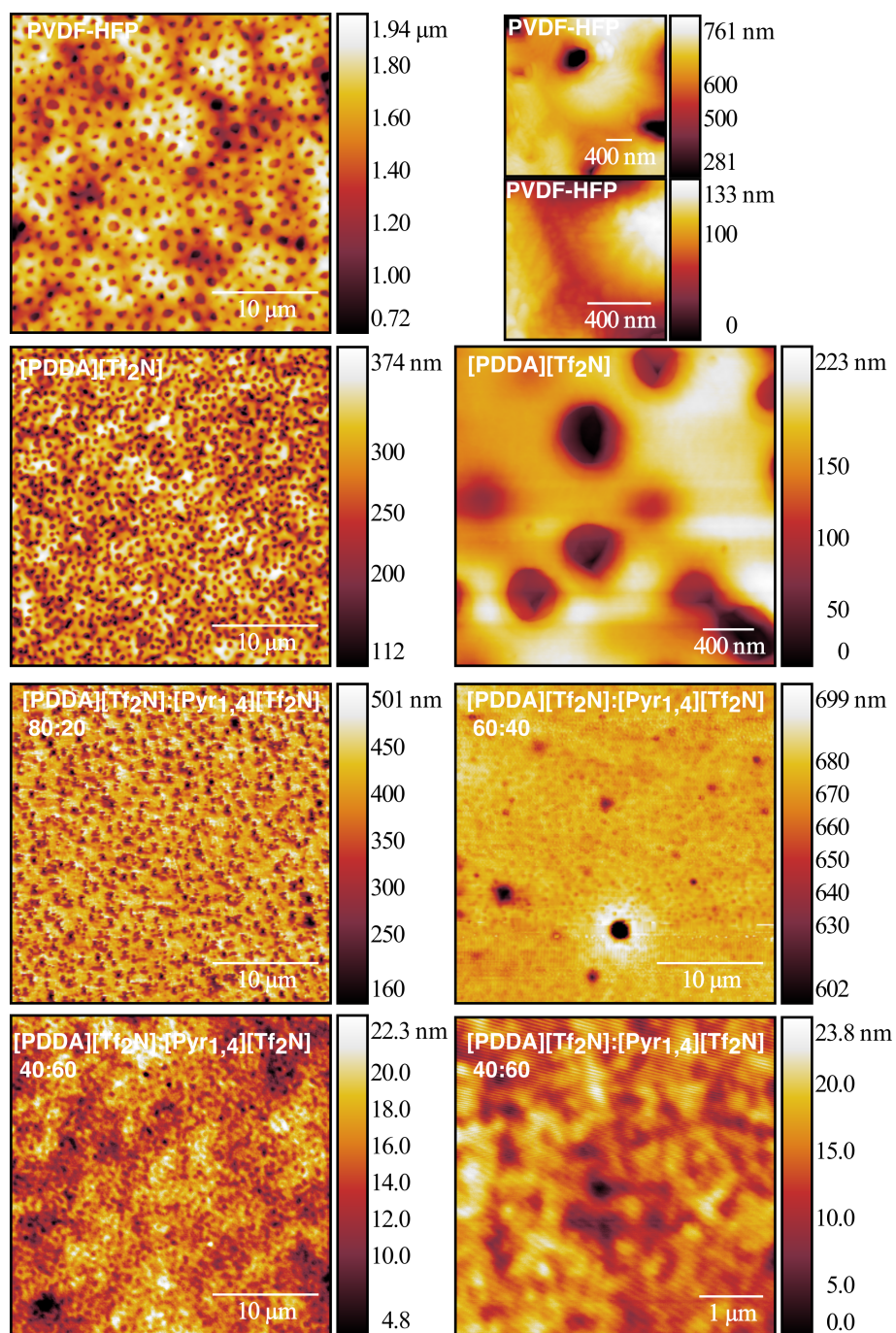


Figure S3. AFM images of drop-cast films of co-polymer (PVDF-HFP), [PDDA][Tf<sub>2</sub>N] [PDDA][Tf<sub>2</sub>N] and mixtures [PDDA][Tf<sub>2</sub>N]:IL 80:20, 60:40 and 40:60.

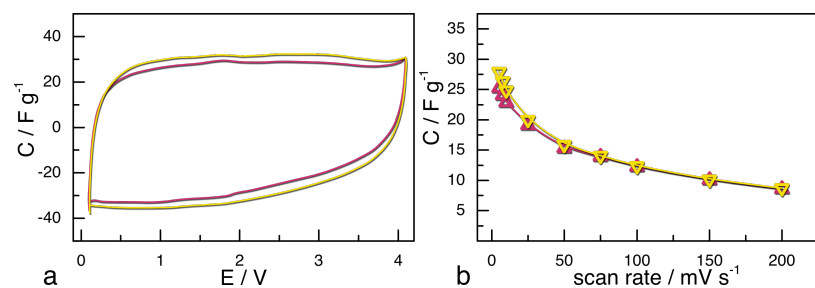


Figure S4. (a) cyclic voltammetry of EDLCs containing poly(IL):IL 80:20 (pink) and 60:40 (yellow) at  $5 \text{ mV s}^{-1}$ . (b) specific capacitance of EDLCs at different scan rates.

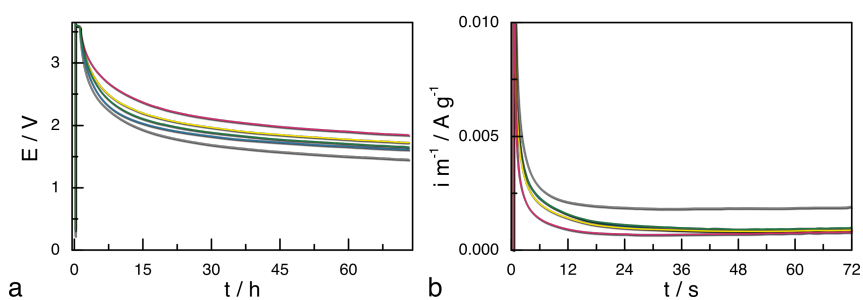


Figure S5. (a) self-discharge and (b) leakage current determination of EDLCs containing copolymer (grey), poly(IL) (blue), mixtures poly(IL):IL 80:20 (pink), 60:40 (yellow) and 40:60 (green).

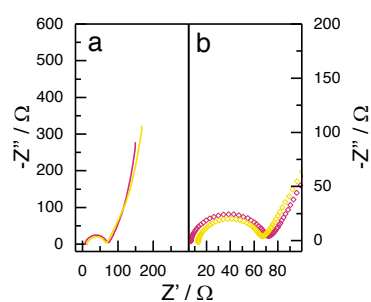


Figure S6. (a) Nyquist plots from EIS of EDLCs containing poly(IL):IL mixture 80:20 (pink) and 40:60 (yellow) as binders and (b) magnified high frequency region.