

Electronic Supplementary Information

Structural origins of the capacity fading in the lithium-polyimide battery

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Table S1. Chemical analysis of the NDI-HY polyimide

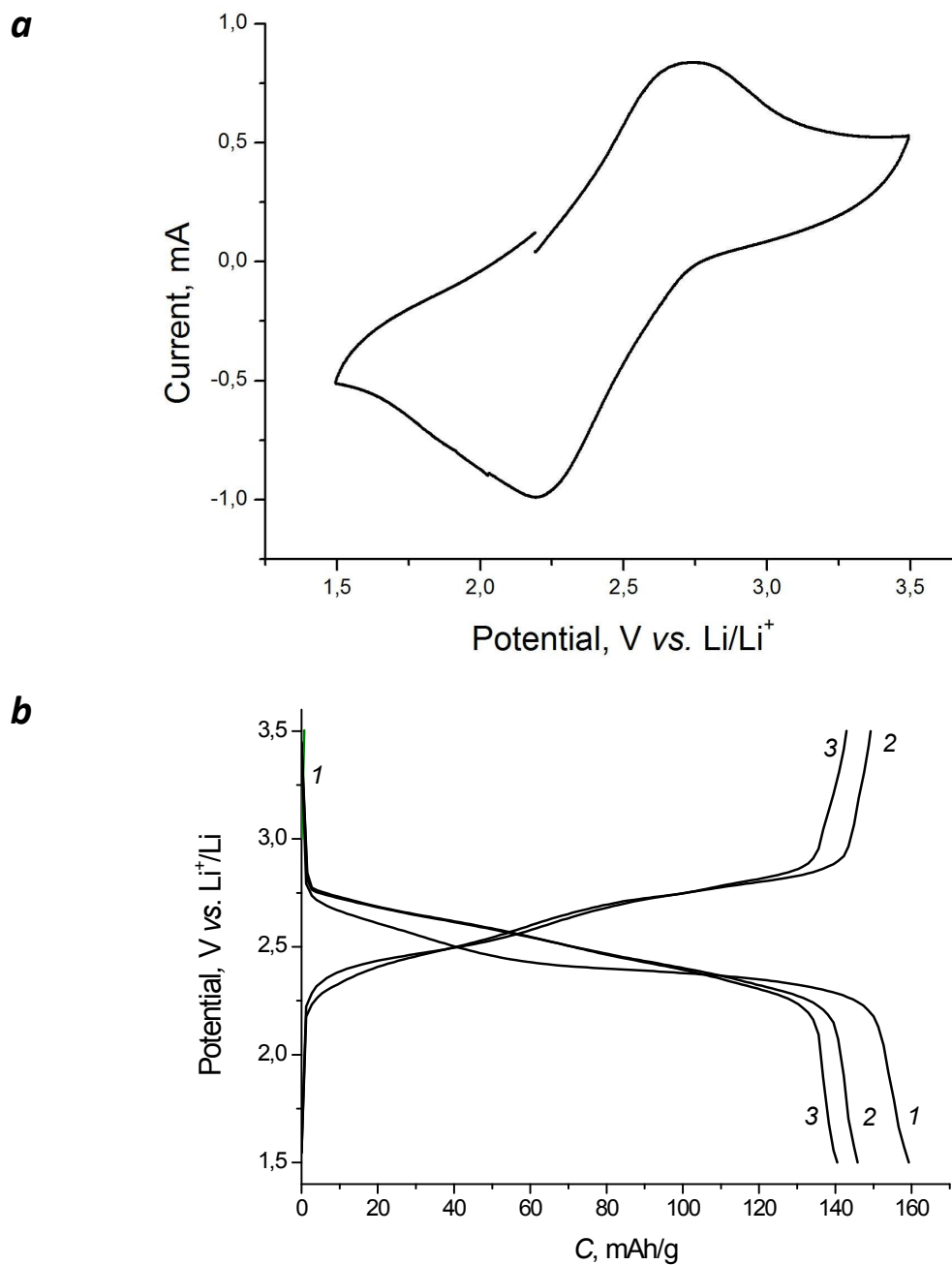


Fig. S1 Cyclic voltammogram of NDI-HY -cathode vs. Li at a scan rate of 2 mV/s (a) and charge-discharge characteristics showing a single plateau in the 1.5-3.5 V potential range (b). Cycle numbers are indicated near the corresponding curves.

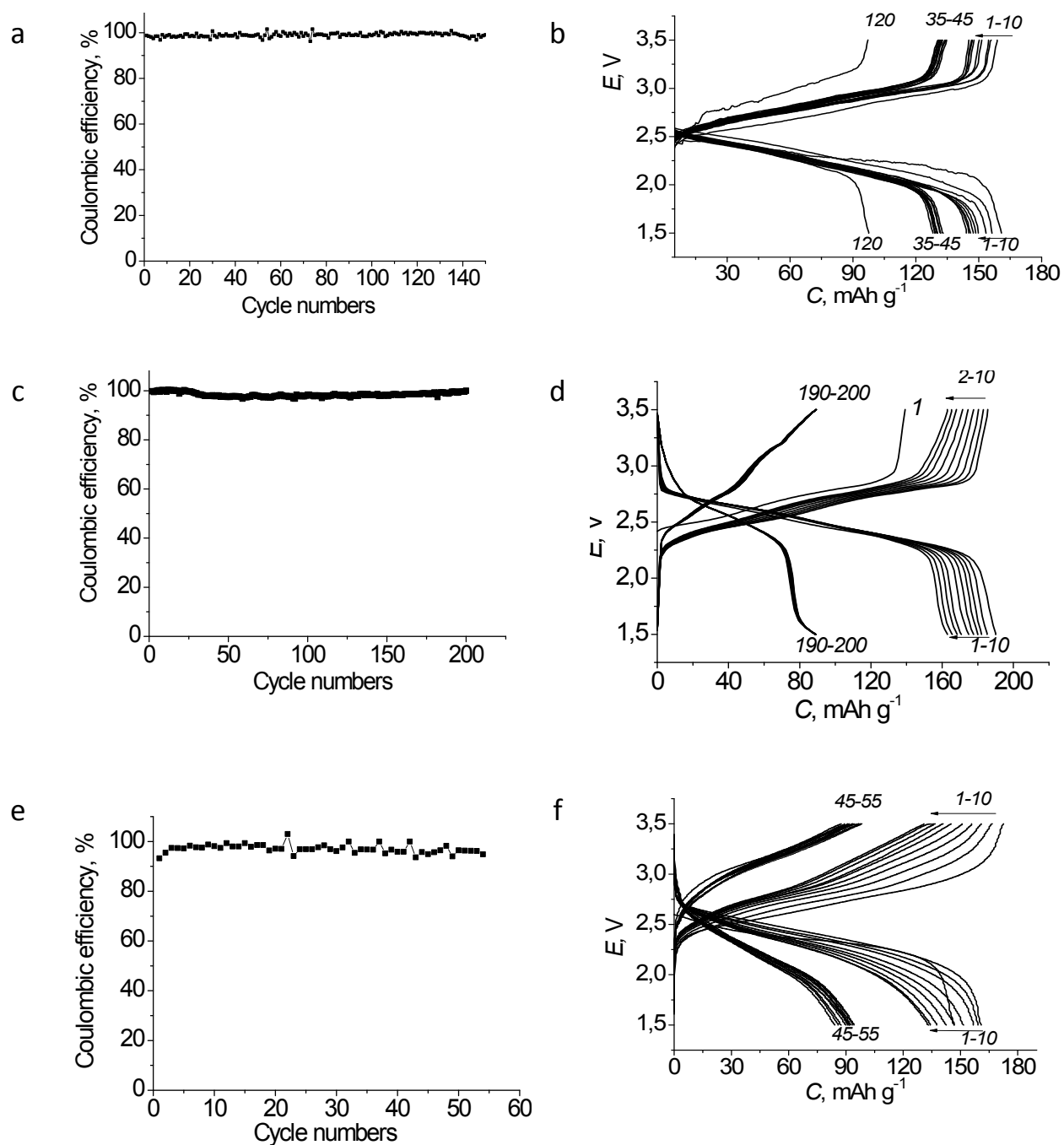
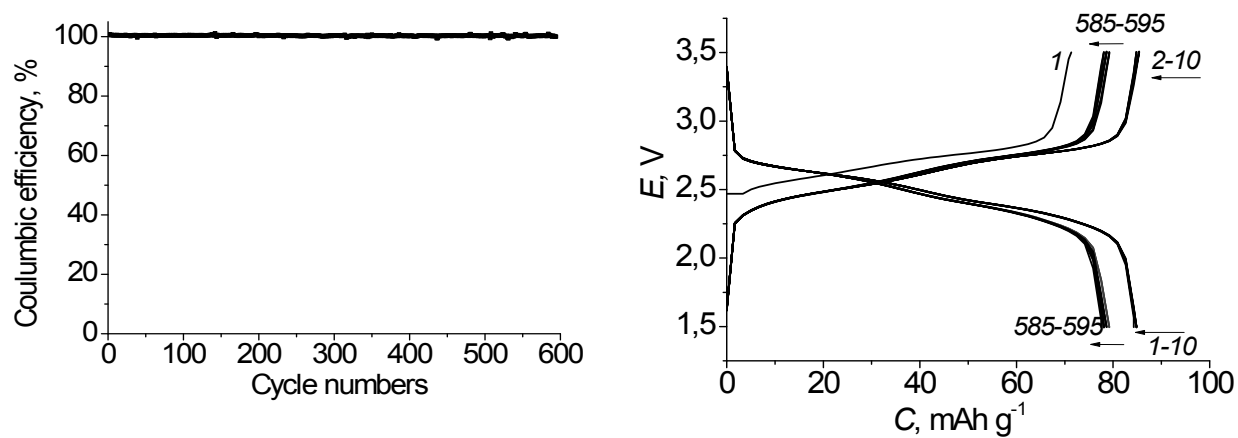


Fig. S2. Coulombic efficiencies (a, c, e) and evolution of the charge-discharge characteristics (b, d, f) of the batteries cycled at different current rates: 2C (a-b); 0.5C (c-d) and 0.1C (e-f). Cycle numbers are indicated near the corresponding curves.



a

b

Fig. S3. Coulombic efficiencies (a) and evolution of the charge-discharge characteristics (b) of batteries assembled with polymer electrolyte (current rate is 0.5C). Cycle numbers are indicated near the corresponding curves.

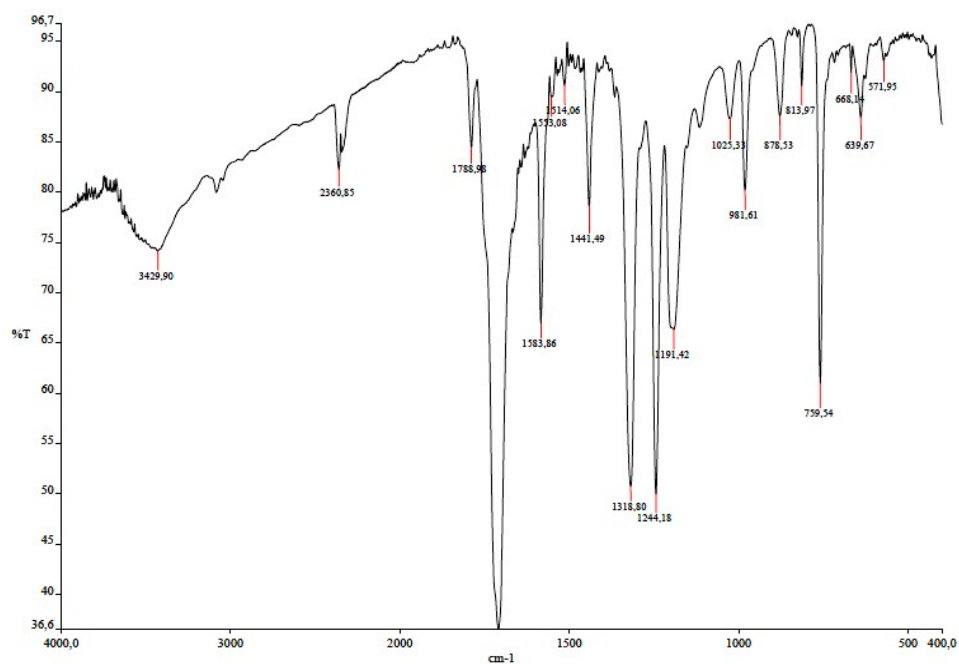


Fig. S4 FTIR spectrum of the NDI-HY

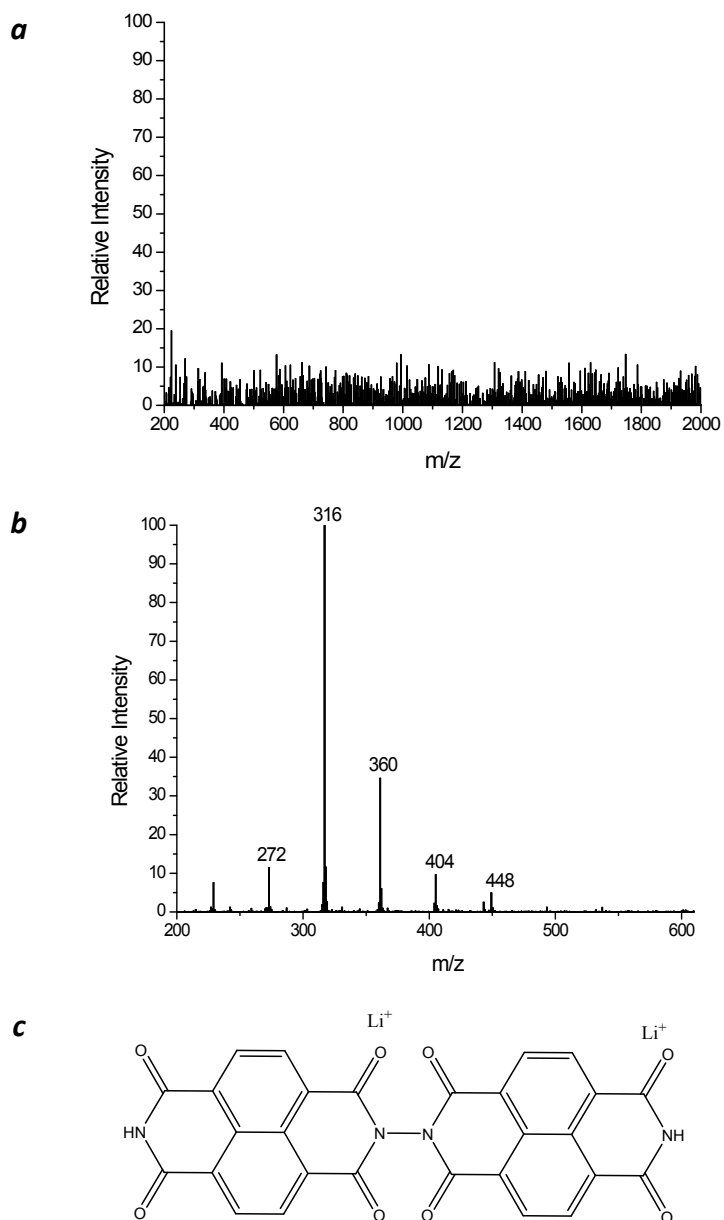


Fig. S5. ESI-MS mass spectra of the electrolyte extracted from the reference non-cycled battery (a) and the battery cycled for 200 cycles at 0.1C (b). Molecular structure of the representative NDI-HY fragment responsible for the appearance of ions M^{2+} ($m/z=272$), $[M+EC]^{2+}$ ($m/z=316$), $[M+2EC]^{2+}$ ($m/z=360$), $[M+3EC]^{2+}$ ($m/z=404$) and $[M+4EC]^{2+}$ ($m/z=448$), where EC is ethylene carbonate.

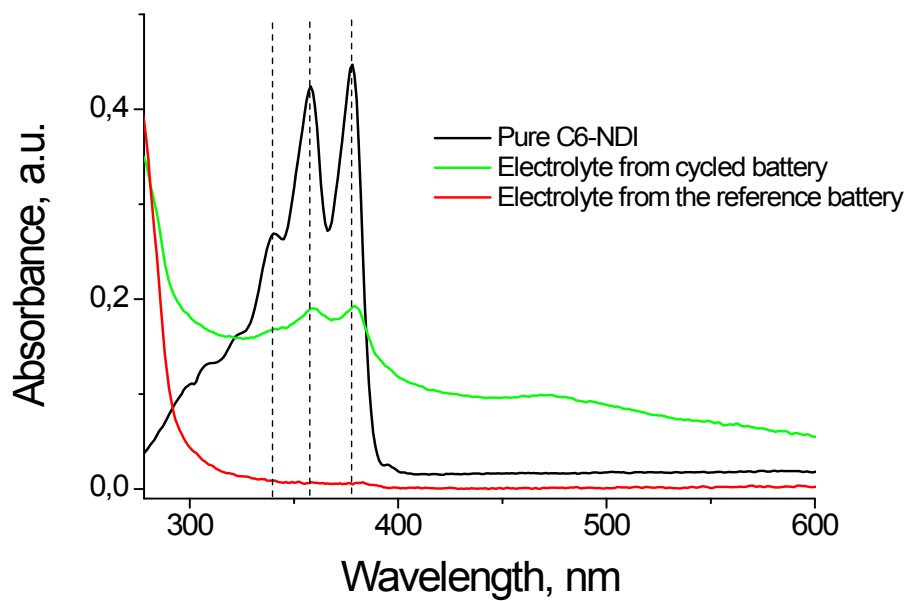
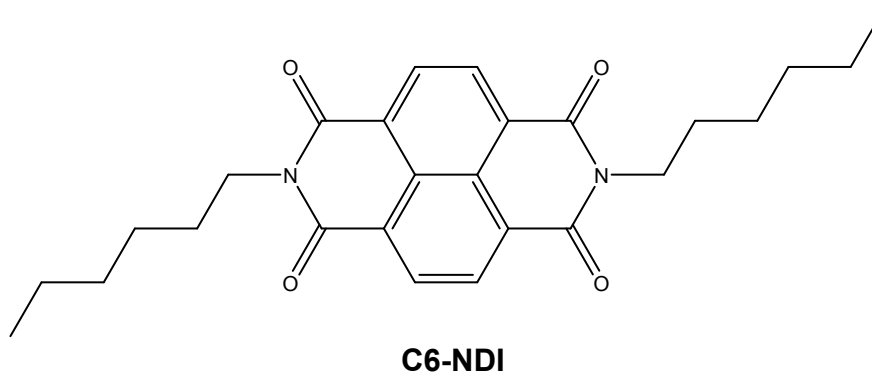
a**b**

Fig. S6. UV-vis absorption spectra of the electrolyte extracted from the reference non-cycled battery, the battery cycled for 200 cycles at 0.1C and pure naphthalene diimide C6-NDI (a). Molecular structure of C6-NDI (b). Vertical lines in (a) marking characteristic NDI absorption features are given as a guide for eye.

Table S1. Chemical analysis of the NDI-HY polyimide

	C, %	H, %	N, %
Calculated	63.65	1.53	10.60
Found	63.37	1.61	10.42