Supporting Information For

Flexible, self-healing and highly stretchable polymer electrolyte via quadruple hydrogen bonding for lithium-ion batteries

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Scheme S1. Synthesis of UPy-based monomer (UPyMA) from 6-methylisocytosine and 2-isocyanatoethyl methacrylate

Figure S1. $^1$H NMR spectrum of the synthesized (2-(3-(6-methyl-4-oxo-1,4-dihydropyrimidin-2-yl)ureido)ethyl methacrylate) (UPyMA).
Figure S2. $^1$H NMR spectrum of the synthesized 4-cyanopentanoic acid dithiobenzoate (CPADB).

Figure S3. $^1$H NMR spectrum of the poly(ethylene glycol) methyl ether methacrylate (PEGMA).

Figure S4. $^1$H NMR spectrum of PEG10-UPy.
Figure S5. FT-IR spectra of the P(PEGMA) and PEG10-UPy.

Figure S6. DSC traces showing the $T_g$ of four types of copolymers and the $T_g$ and $T_m$ of P(PEGMA).
**Figure S7.** The photo of polymer of P(PEGMA) without UPyMA.

**Figure S8.** Dynamic frequency sweep for PEG5-UPy at 60 °C.
Figure S9. The electrochemical stability window of the shPE.

Figure S10. Chronoamperometry of the Li/P(PEGMA)/Li cell at a potential step of 10 mV. The inset shows the AC impedance spectra before and after polarization at 60 °C.

Figure S11. The stress-strain profile of PEG5-UPy.
Figure S12. Demonstration of the P(PEGMA) attached to a metal surface to support 10 g of mass.

Figure S13. Rate performance of the LFP/shPE/Li cell at 60 °C.