Electronic Supplementary Information for

Organic Polymer Material with Multi-Electron Process Redox Reaction: Towards Ultra-High Reversible Lithium Storage Capacity

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Experimental Details

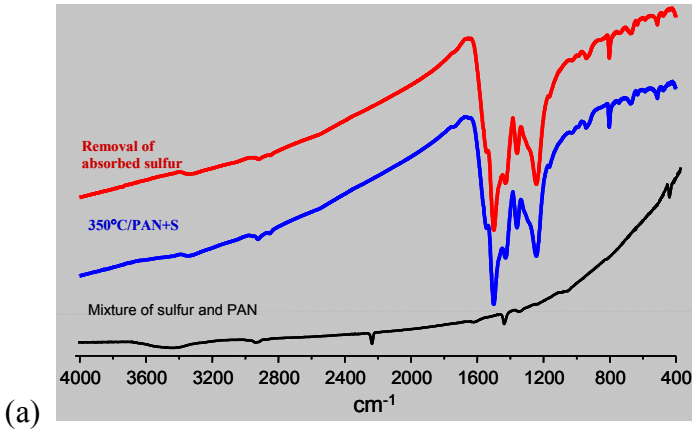
Materials: Sulfur and PAN were purchased from Aldrich and used as received. Sulfur and PAN were mixed with ball-milling (QM, Nanjing University Instrument Plant, China) at 500 rpm for 6 h in ethanol medium, followed by drying at 60 °C in vacuum for 24 h. The mixture was heated at 350 °C for 10 h in a sealed stainless vessel, then cooling to room temperature. Then sulfur grafted poly(pyridinopyridine) was obtained by heating the above sample at 150 °C in a vacuum till the weight kept constant. Elemental analyses of C, H, and N were recorded using Vario EL and S was analyzed by typical oxygen bottle combustion and barium salt titration.

Characterization: Powders of the prepared samples were used directly for Fourier-transform infrared (FT-IR) and UV-Vis measurements. FT-IR spectra of the samples in solid state (KBr matrix) were recorded using a Spectrum RX/BX (Perkin Elmer) spectrometer with 1 cm^{-1} resolution. The UV-Vis spectra were recorded on UV-1700 (Shimazu) instrument with 1 nm resolution. Raman measurements were performed in a Renishaw 2000 spectrometer with laser wavelength of 632.8nm.

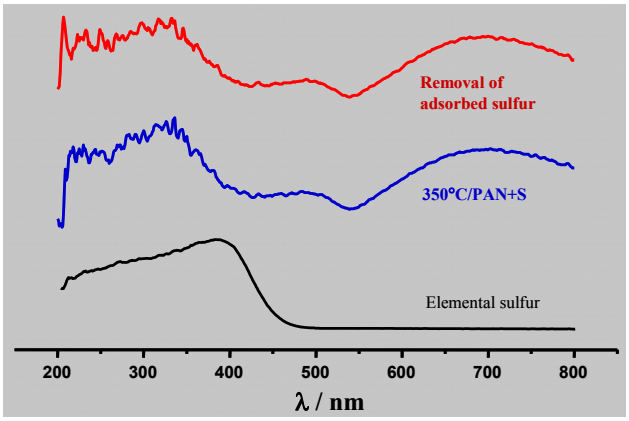
Electrochemical measurements were performed using CR2032 coin-type cells assembled in an argon-filled glove box. The working electrodes were made by pressing a 0.8 cm^2 thin film (containing 80 wt% SPPY material, 10 wt% acetylene black, 10 wt% polyacrylonitrile as binder) onto a Ni mesh. The electrodes were dried in a vacuum oven at 80 ^oC for 24 h before test. Electrochemical cells were assembled with the composite as cathode, metallic lithium disk as anode, Celgard2400 porous film as separator. The electrolyte used in this work was a mixed solution of 1 M $LiPF_6$ dissolved in a mixed solvent of ethylene carbonate (EC), dimethyl carbonate (DMC), and ethylene methyl carbonate (EMC) (1:1:1 by volume.). Charge–discharge experiments were performed galvanostatically with current density of 10 mA g^{-1} between 1.0 and 3.0 V (or between 0.0 and 3.0 V) on battery testers (Land CT2001A). The cells were cycled at room temperature.

Table S1 Composition of SPPY

	H	N	C	S
composition / wt%	1.2	16.2	41.6	41.0
composition / mole	1.0	1.0	3.0	1.1



(a)



(b)

Fig. S1 FT-IR transmittance (a) and UV-Vis absorbance (b) spectra of SPPY before and after sulfur removal.