Electronic Supplementary Material (ESI) for ChemComm.

Supporting Information

Fabrication of Porous Polyimide as Cathode for High Performance Lithium-ion Battery

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Experiment and methods

Fabrication of Porous Polyimide

Melamine (MA, 99.0%) and pyromellitic dianhydride (PMDA, 99%) were dried at 90°C for 8 h under vacuum condition without further purification. 1.27 g of MA was added in 30 mL of distilled DMSO under mechanical stirring for 15 min. 3.32 g of PMDA added into the above solution. The resultant mixed solution was stirred at 25 ℃ for 45 min with N_2 atmosphere. Afterwards, 2 mL of toluene was dropped in the flask with the temperature raising to 180 °C and holding for 72 h. The produced water would get away from the reaction mixed solution via the azeotropic distillation. The prepared solid precipitate was washed with excess acetone, tetrahydrofuran and dichloromethane. Finally, the porous PI was achieved under vacuum at 60 °C.

Characterization of Porous Polyimide

XRD pattern was recorded with the 2θ range from 10° to 80° (Rigaku MiniFlex600, CuKα radiation). FTIR curves were achieved via the wavemeter of 4000 - 400 cm^{-1} at room temperature (Tianjin Gangdong, FTIR-650 Spectrometer). Raman patterns were measured at 532 nm excitation laser by Raman microscope (DXR, Thermo-Fisher Scientific). XPS was carried out Kratos Axis Ultra DLD. Scanning electron microscopy (SEM, JEOL, 78500F) and transmission electron microscopy (TEM, Philips, F20) were applied to see the morphology and structure of porous PI electrode.

Electrochemical Measurements

PI cathodes were prepared by mixing 60% PI with 30 wt% Super P; 50 wt% PI with 40 wt% PI; 30% PI with 60% Super P and 10 wt% of PVDF binder. Lithium foil and $LiClO_4$/EC/DEC respectively as the counter electrode and electrolyte were assembled in a glovebox using the CR2032 coin cells. The discharge-charge curves

were tested ranging in the potential of 1.2-3.5 V at various current densities by the Land CT2001A. Impedance measurements were recorded with the amplitude of ±5 mV by the frequency range of 100 kHz - 100 mHz via the impedance analyzer workstation.

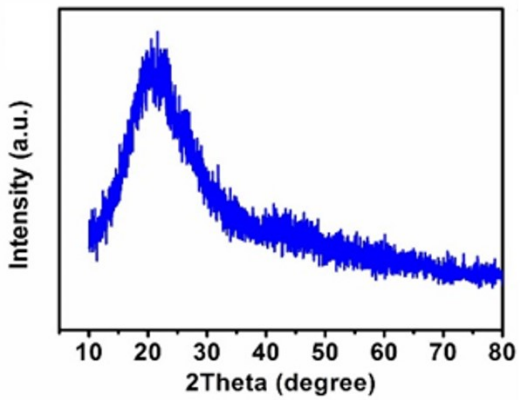

Fig. S1 XRD pattern of porous PI cathode.

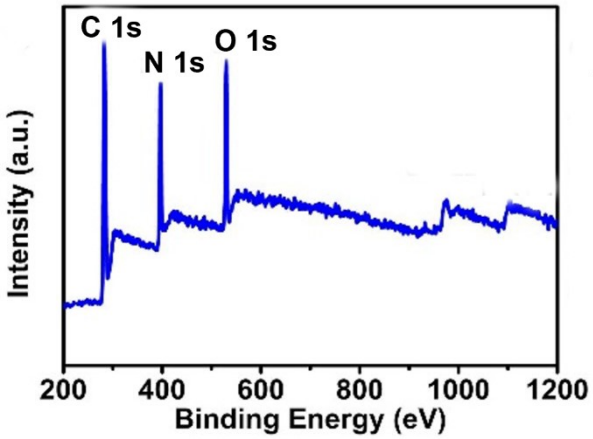

Fig. S2 XPS spectra of porous PI.

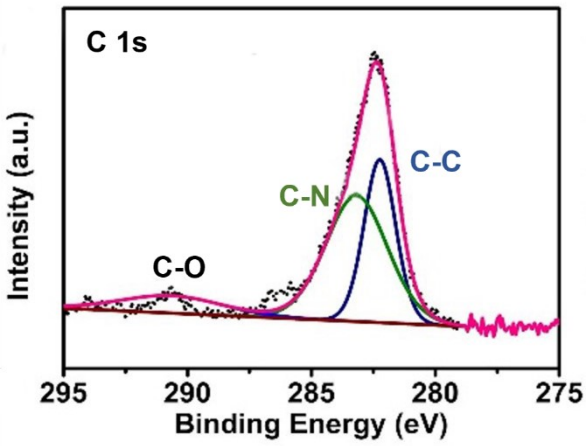

Fig. S3 C1s XPS spectra of porous PI.

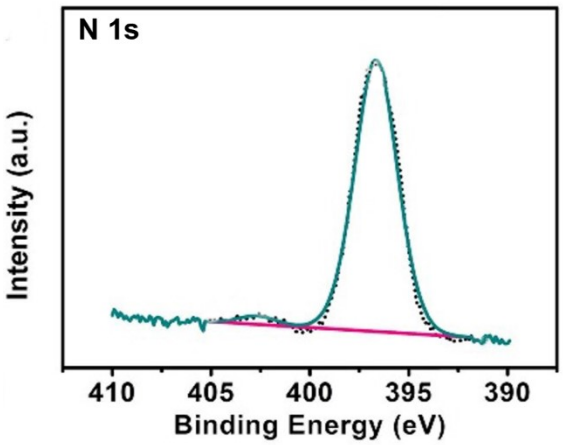

Fig. S4 N1s XPS spectra of porous PI.

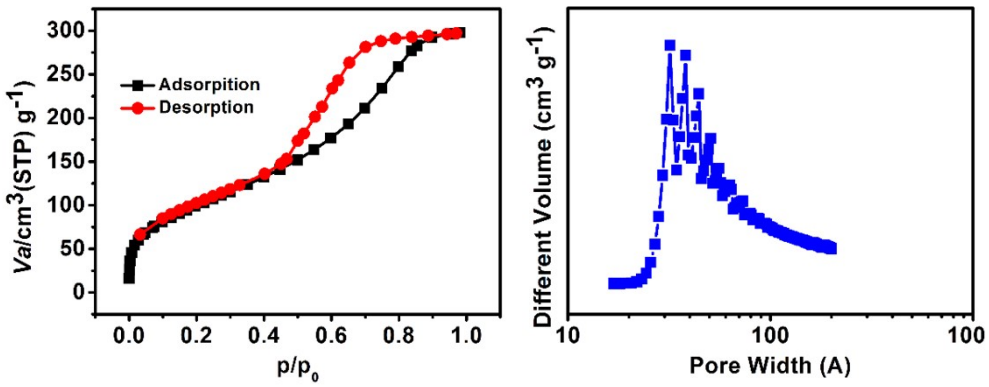

Fig. S5 The nitrogen adsorption–desorption isotherms and pore-size distributions of porous PI.

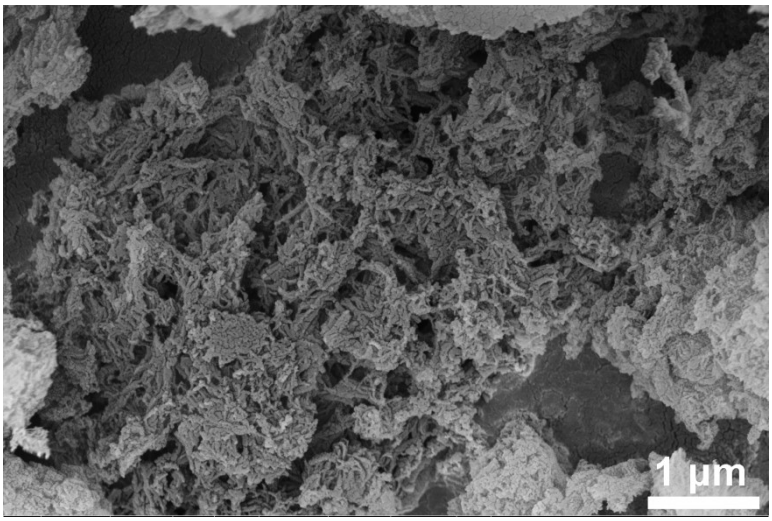

Fig. S6 SEM image of porous PI.

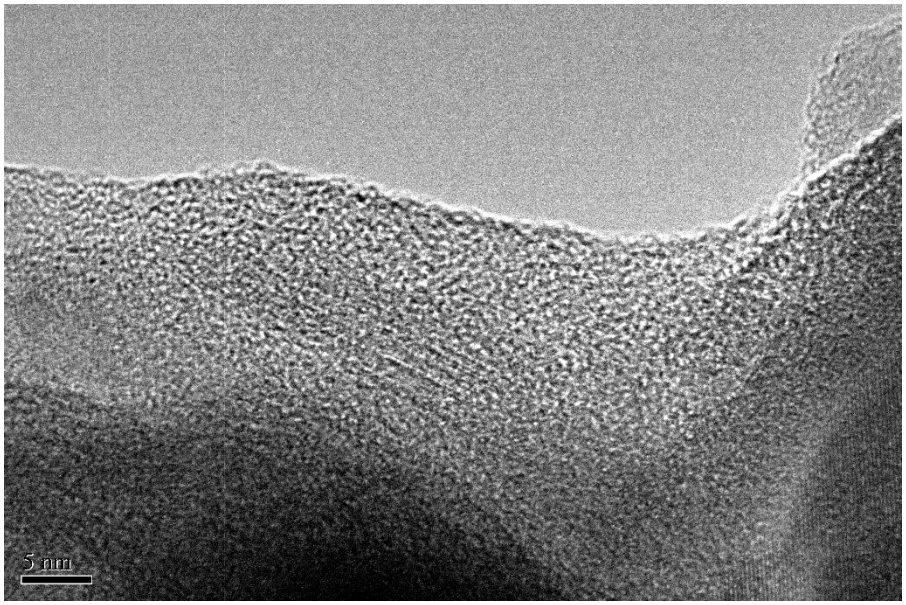

Fig. S7 HR-TEM image of porous PI.

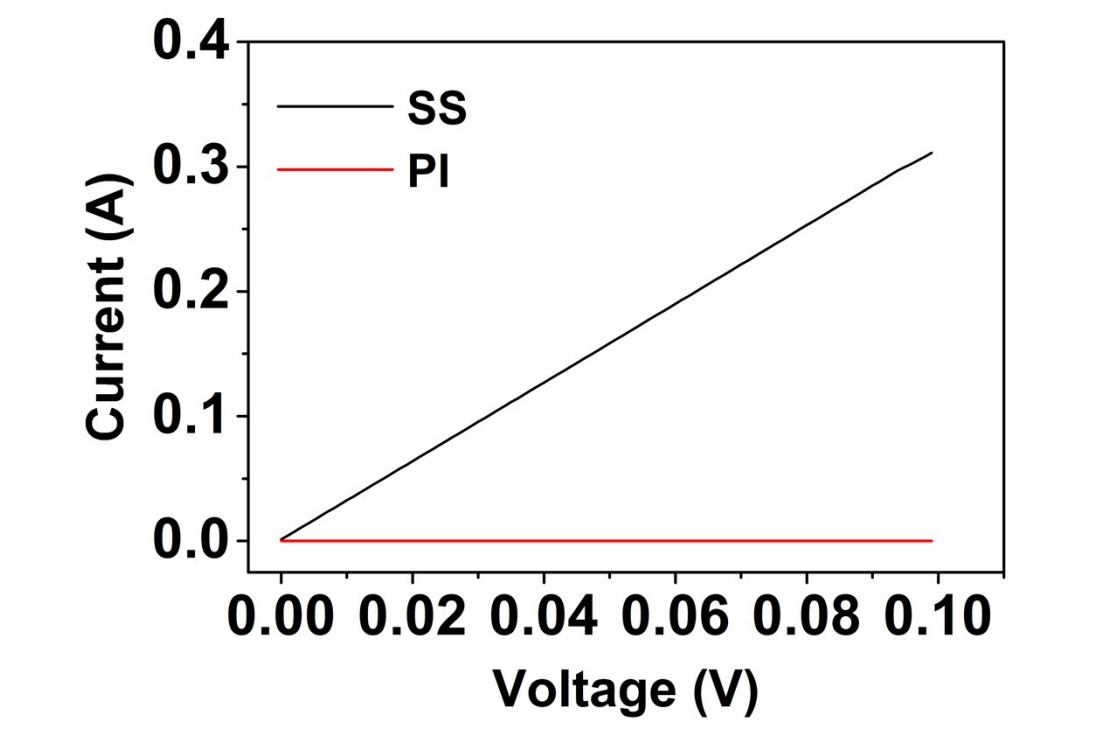

Fig. S8 The electrical conductivity measurement of PI.

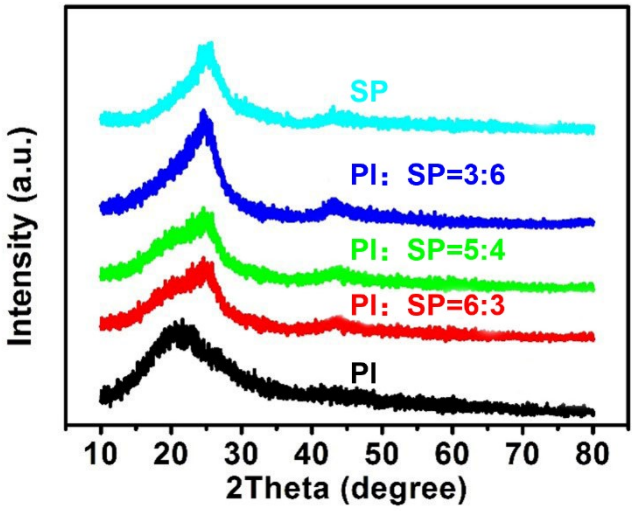

Fig. S9 XRD patterns with different ratio of PI and Super P (SP).

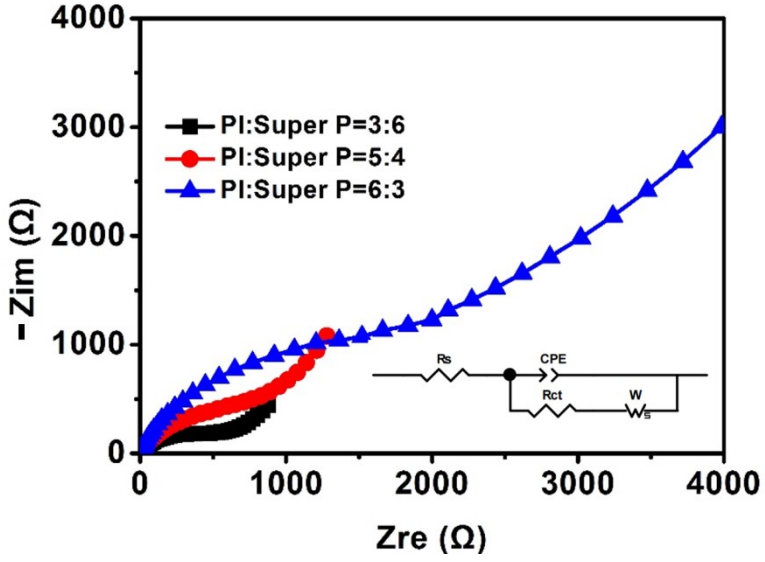

Fig. S10 Electrochemical impedance spectra of PI with different weight ratio of Super P.

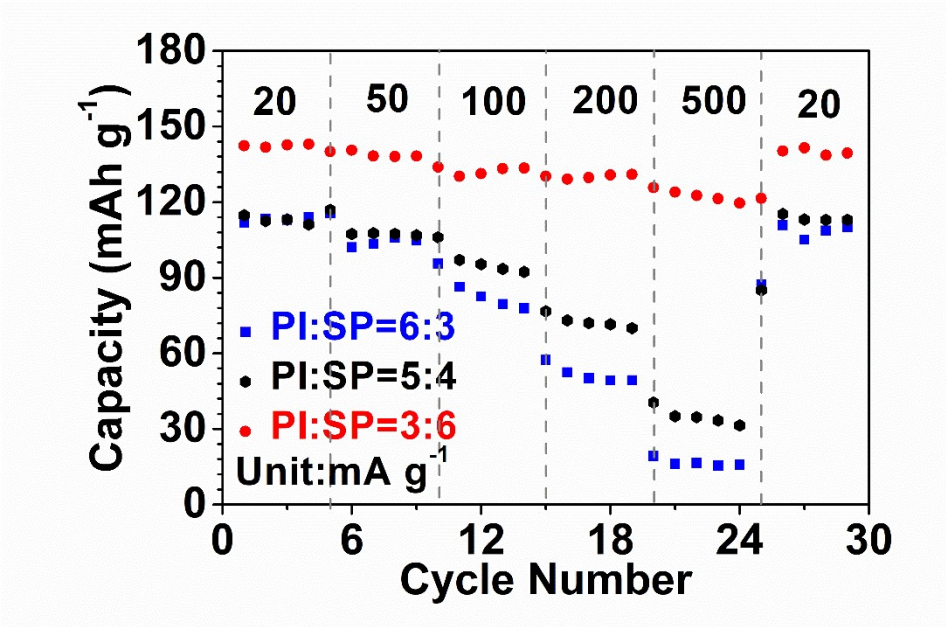

Fig. S11 Rate performance of PI with different weight ratio of Super P at various current densities.

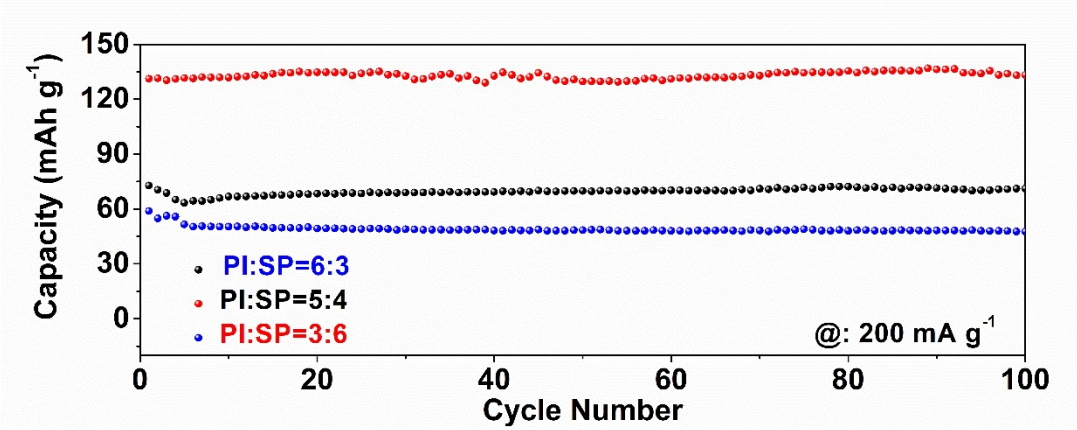

Fig. S12 Cycle performance of PI with different weight ratio of Super P at 200 mA g^{-1}.

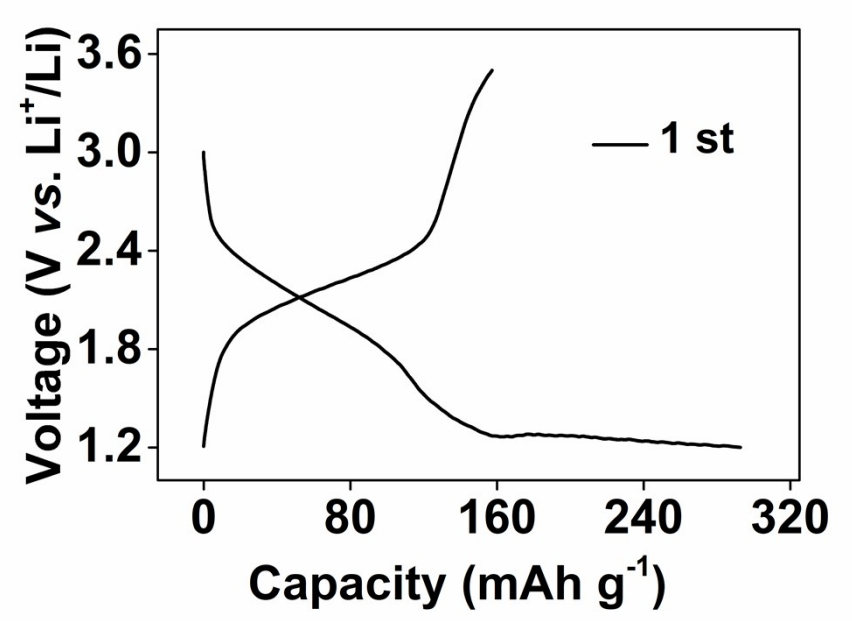

Fig. S13 The first charging and discharging curves at 20 mA g^{-1}.

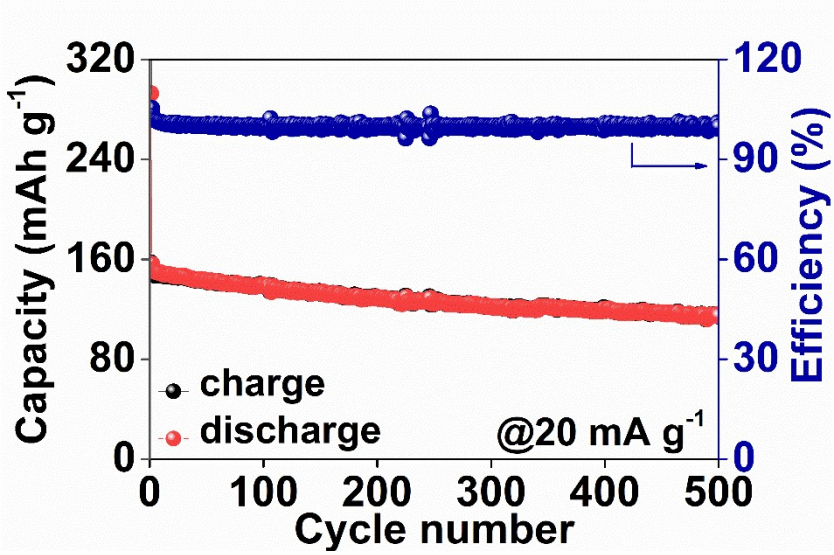

Fig. S14 The cycle performance of PI electrode at 20 mA g^{-1}.

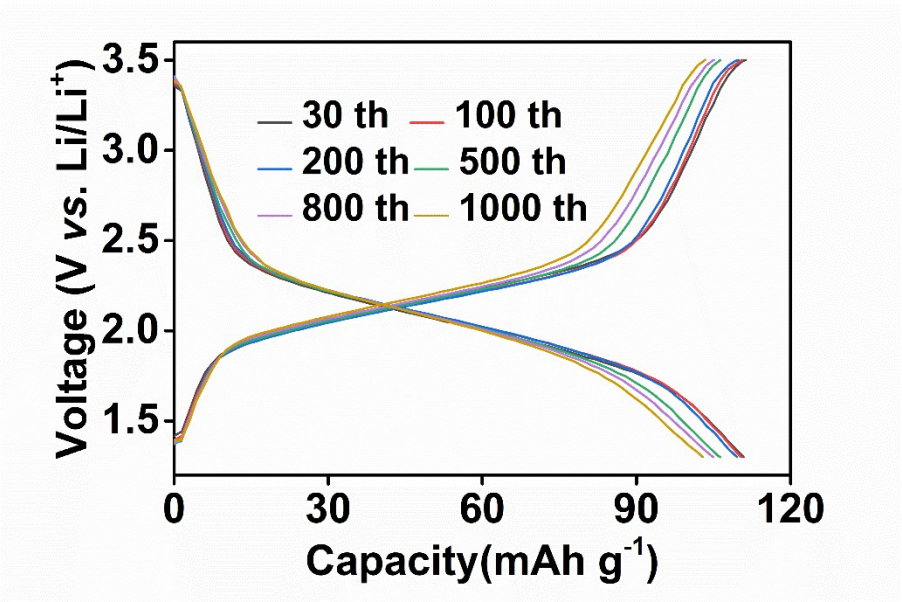

Fig. S15 The charging and discharging curves of different cycles at 500 mAg^{-1}.