Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Sulfur Quantum Dots Wrapped by Conductive Polymer Shell with Internal Void Spaces for High-Performance Lithium-Sulfur Batteries

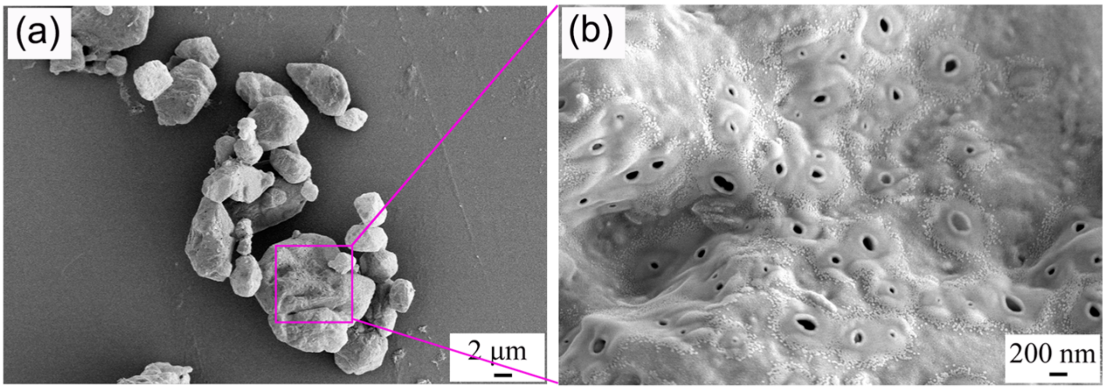

Fig. S1. SEM images of S treated with CS_2. Elemental sulfur was directly dissolved in CS_2 and magnetic stirred at 40 °C, plenty of nanopores and nanoparticles (b) formed and precipitated on the surface of large sulfur particles (a) as the CS_2 solvent vapored out.

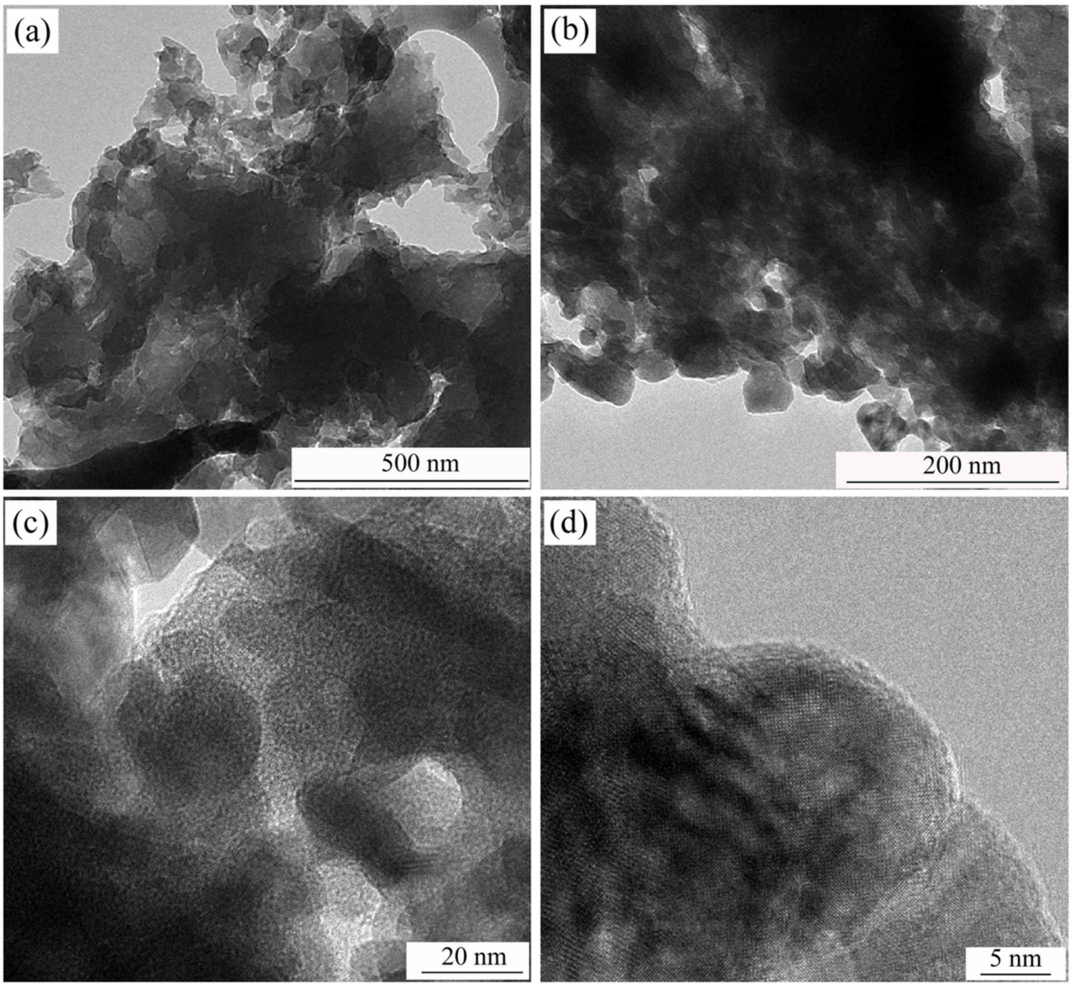

Fig. S2. TEM images of the S/PVK composites.

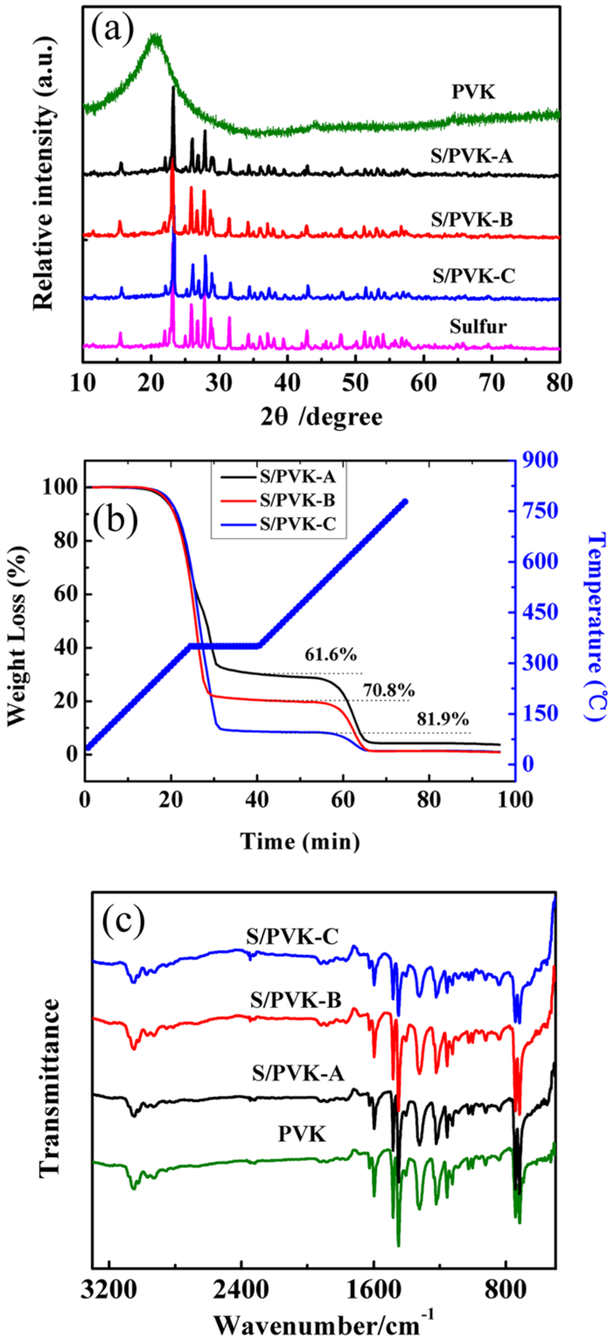

Fig. S3. (a) XRD patterns of S/PVK nanocomposites with different S content. (b) Thermal gravimetric analysis (TGA) of S/PVK nanocomposites. (c) FT-IR spectra of S/PVK-A, B and C. The TGA measurements of S/PVK and SQD/PVK composites were measured in a two-stage heating procedure under nitrogen flow which were first heated in the range of 50-350 °C at a heating rate of 10 °C/min, and then maintained at this temperature for 20 minutes before heating to 800 °C with the same heating rate. TGA measurement of pure PVK was measured from 50-800°C at a heating rate of 10 °C/min.

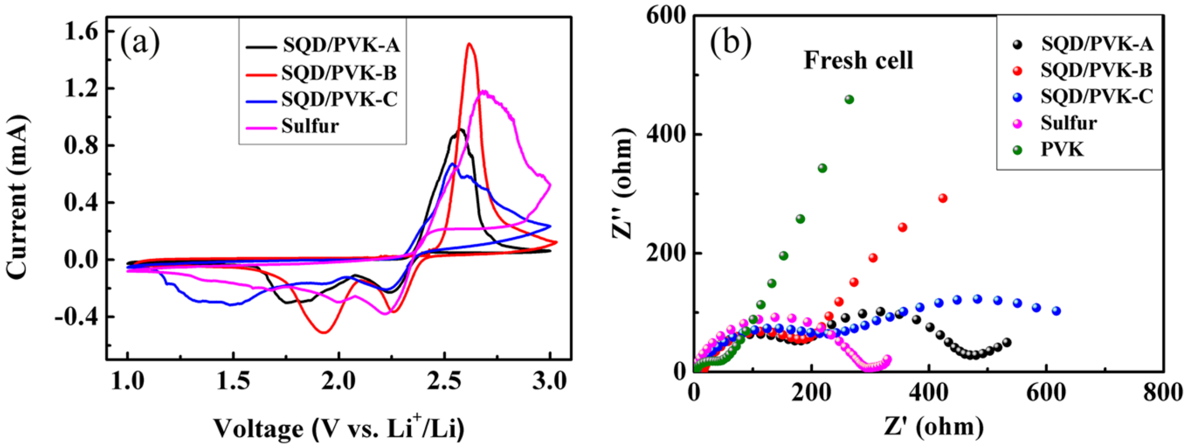

Fig. S4. (a) Cyclic voltammograms of sulfur and the SQD/PVK composite electrode at 0.05 mV s^{-1} at 1.0 to 3.0 V vs. Li/Li^{+}. (b) Nyquist plots of the electrode for the different SQD/PVK nanocomposites, pure PVK and pure sulfur cathode before cycling from 200 kHz to 100 mHz at room temperature.

Table S1 A Comparison of the Electrochemical Performance of Conducting Polymer/S Composites from Literatures

sample	sulfur content (wt%)	cycling performance				Ref.
		current	reversible DC	cycles	capacity retention	
[b]PANI/S	62	1 C	432	500	76%	22
[c]PTh/S	71.9	0.0625 C	830.2	80	74.2%	21
[d]PPy/S	77	0.5 C	726	500	60%	24
[e]PEDOT/S	72	0.25 C	930	50	83%	25
PANI/S	82	0.5 C	628	200	68.3%	23
[f]PEDOT: PSS/S	unknown	0.2 C	600	150	52.6%	33
S/PVK	**70.8**	**0.5 C**	**687.7**	**200**	**89.7%**	**this work**
		0.5 C	**488.6**	**600**	**63.8%**	**this work**
		0.75 C	**656.5**	**80**	**92.1%**	**this work**
		0.75 C	**608.4**	**150**	**85.4%**	**this work**

1 C=1672~1680 mA g^{-1}, DC[a] is the discharge specific capacity/mAh g^{-1}, [b]PANI is the abbreviation of polyaniline, [c]PTh is polythiophene, [d]PPy is polypyrrole, [e]PEDOT is poly(3,4-ethylenedioxythiophene), and [f]PEDOT:PSS is poly(3,4-ethylenedioxythiophene)-poly(styrene sulfonate)

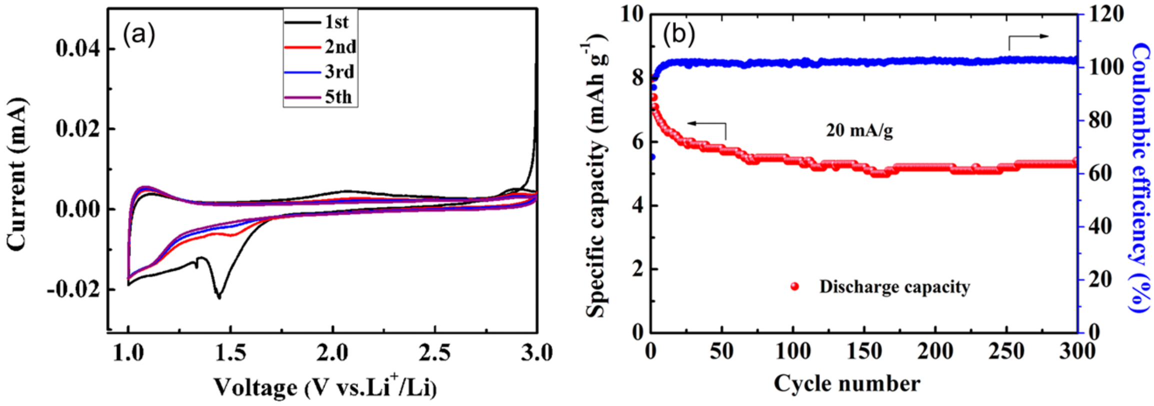

Figure S5. (a) CV curves of the pure PVK electrode at a scan rate of 0.05 mV s^{-1}. (b) Cycling performance of pure PVK electrode at a current density of 20 mA g^{-1}.

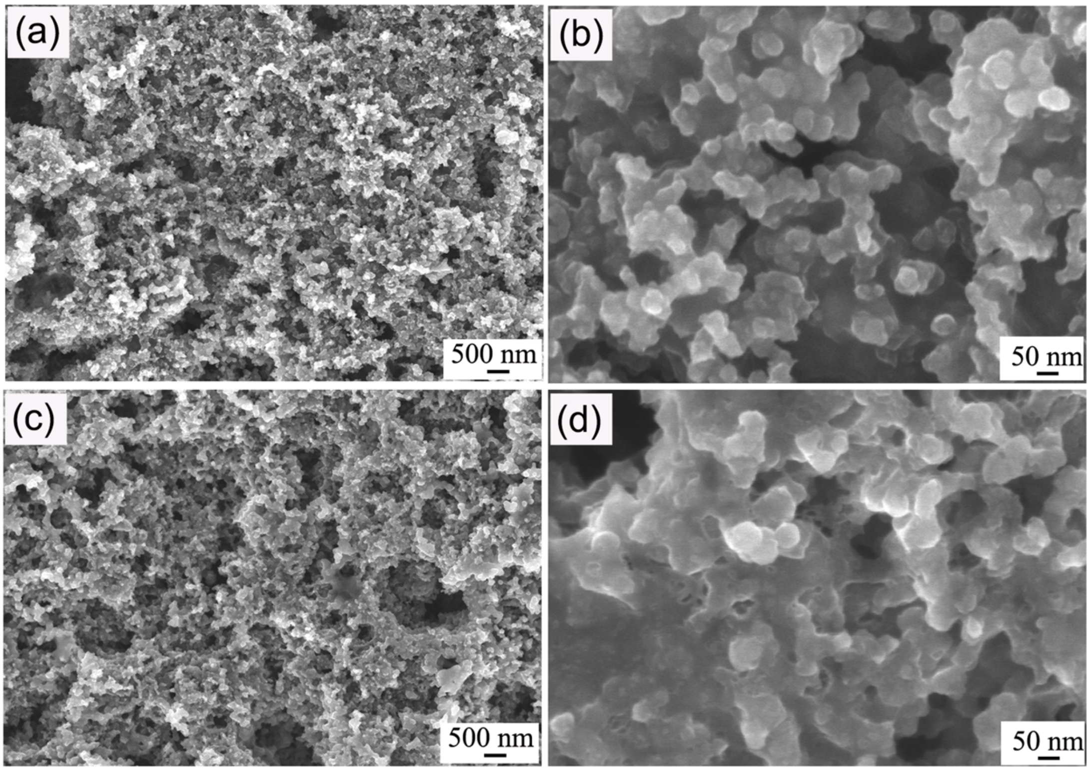

Figure S6. SEM images of the SQD/PVK-B electrode before cycling (a and b), and after 500 cycles (c and d).