Electronic Supplementary Material (ESI) for Nanoscale Horizons.

Information

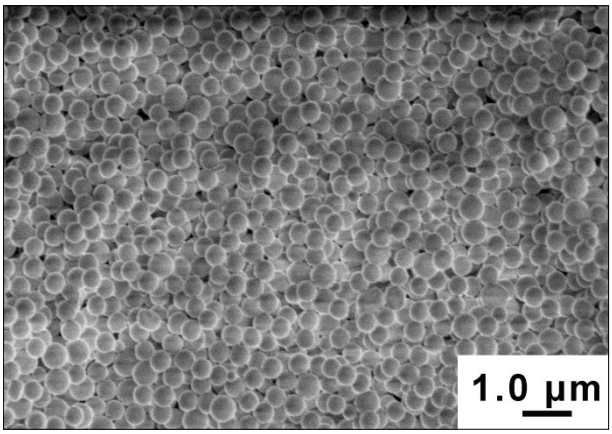


Fig. S1 SEM image of sulfonated polystyrene spheres (sPS).

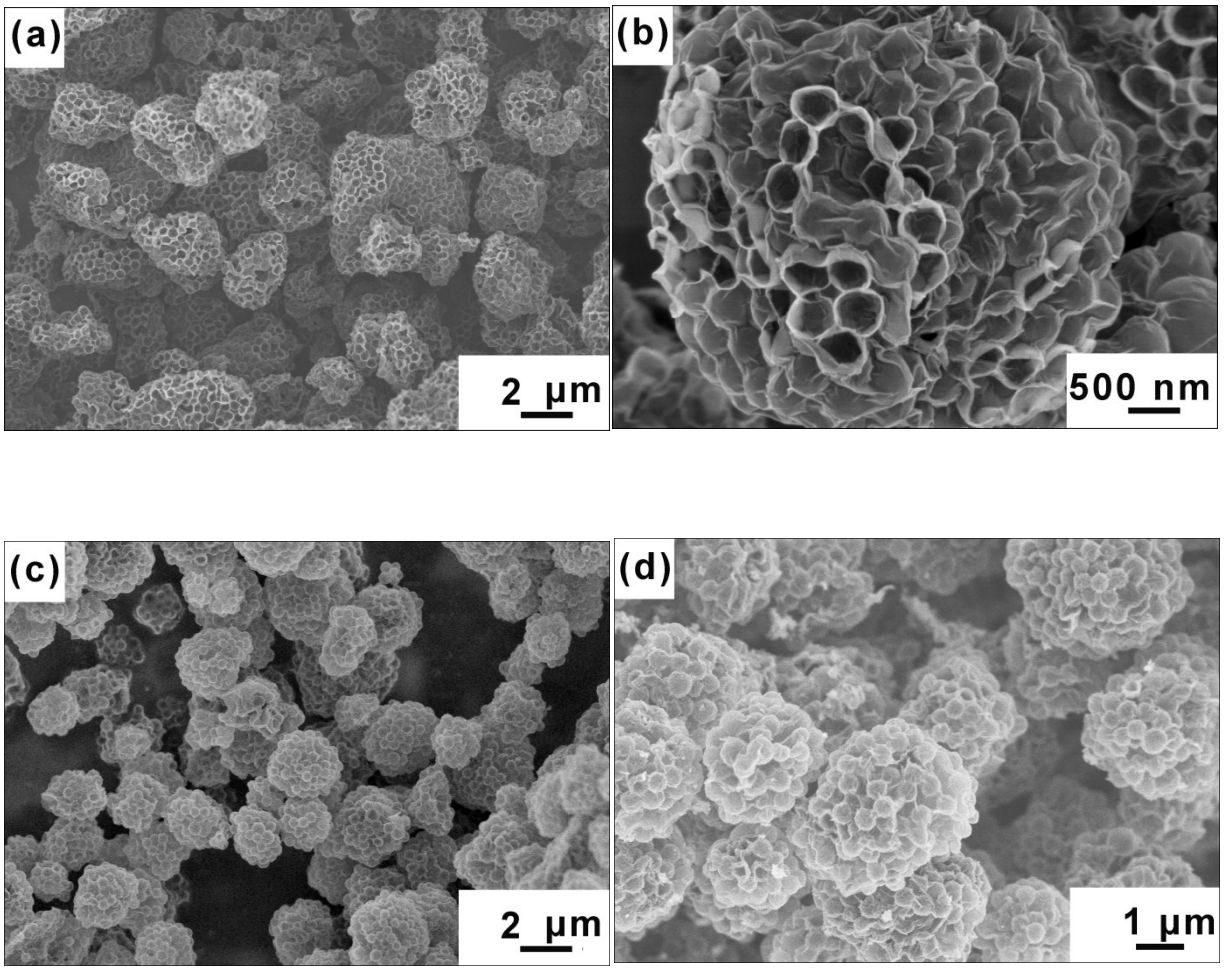


Fig. S2 SEM images of (a, b) PG and (c, d) PTG composites.

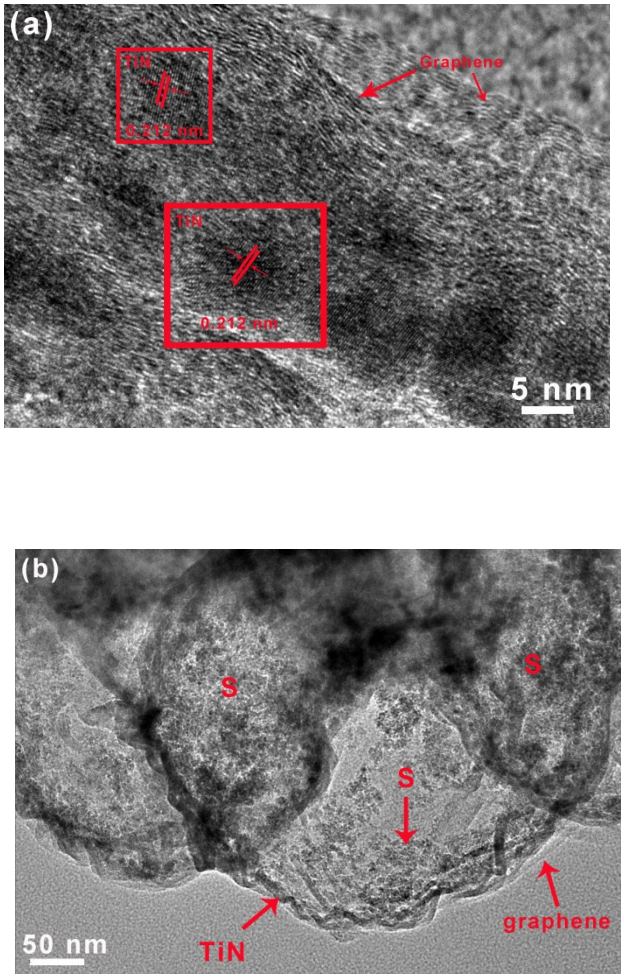


Fig. S3 (a) High-resolution TEM (HRTEM) image of PTG composites; (b) TEM image of PTG/S composites.

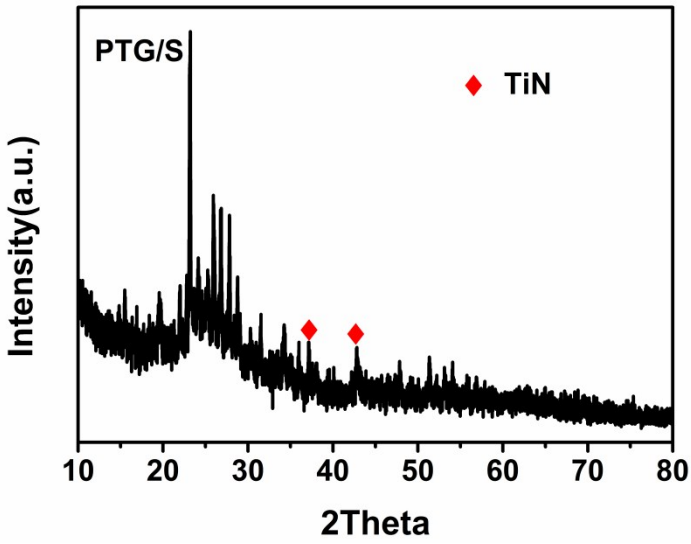


Fig. S4 XRD pattern of PTG/S composites.

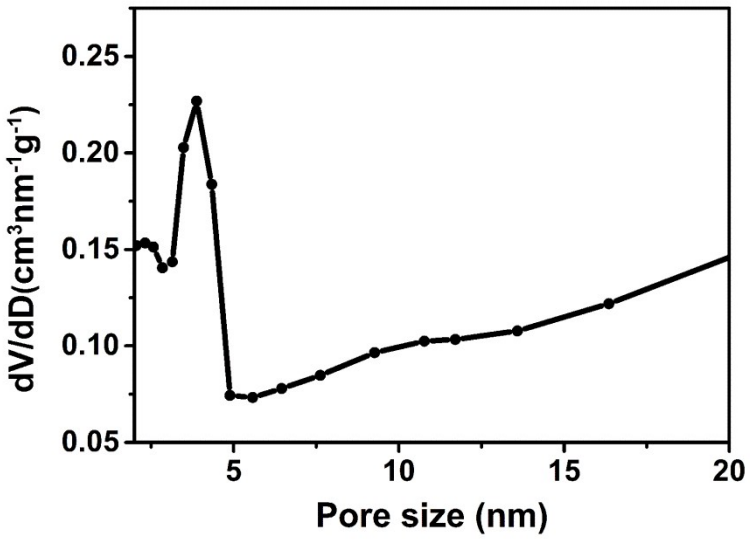


Fig. S5 Pore size distribution curve of PTG composites.

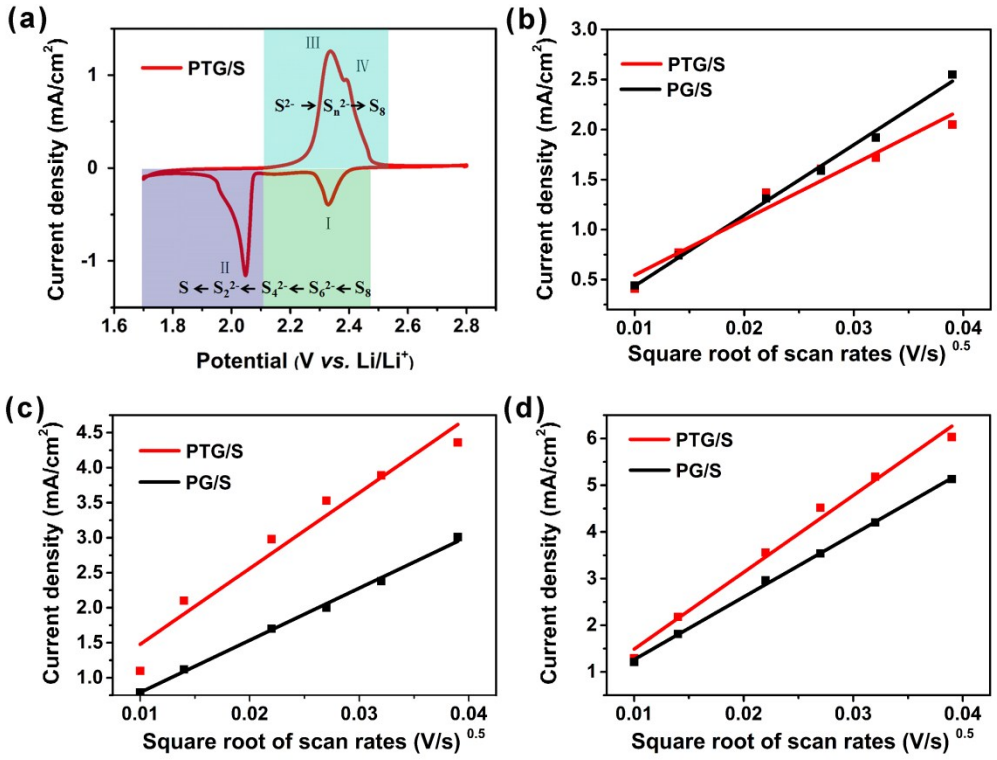


Fig. S6 (a) CV curves of PTG/S cathodes in the range of 1.7-2.8 V at a sweep rate of 0.1 mV s^{-1}; and linear plots of peak current vs square root of scan rate of (b) cathodic reaction I (S_8-Li_2S_4), (c) cathodic reaction II (Li_2S_4-Li_2S), and (d) anodic reaction III (Li_2S-S_8) of PG/S and PTG/S cathodes.

CV tests for the two electrodes were performed at different sweep rates of 0.1, 0.2, 0.5, 0.75, 1 and 1.5 mV s^{-1} (**Fig. 4b and c**). The peak currents have a linear response with the square root of scan rate, according to the Randles-Sevcik equation:

$$I_p = (2.69 \times 10^5) n^{3/2} A D^{1/2} v^{1/2} C_0 \qquad (S1)$$

in which I_p is the peak-current, n is the number of electrons during the redox reaction, A is the active area of the corresponding electrode, D is the lithium ion diffusion coefficient, v is the scan rate and C_0 is the molar concentration of lithium ions. The n, A and C_o are constant for a battery system.

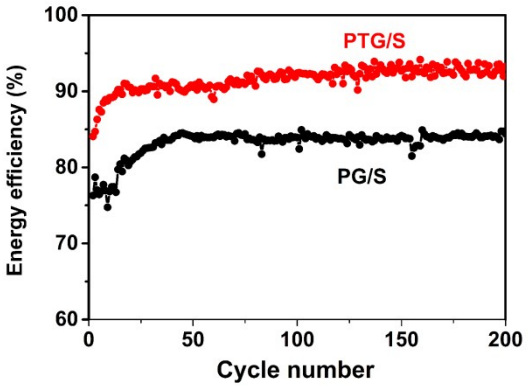
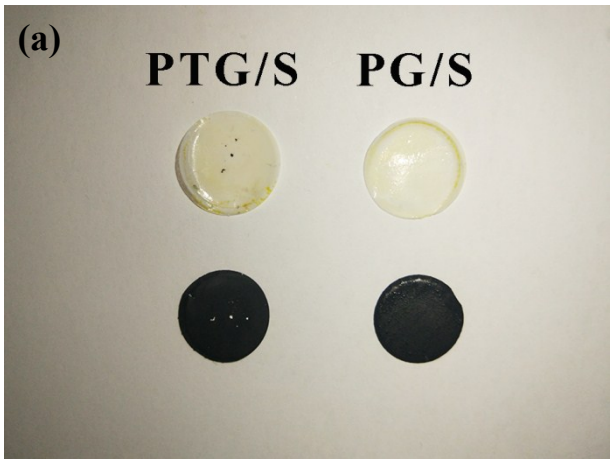


Fig. S7 Energy efficiencies of PTG/S and PG/S cathodes at a current density of 0.5 C.



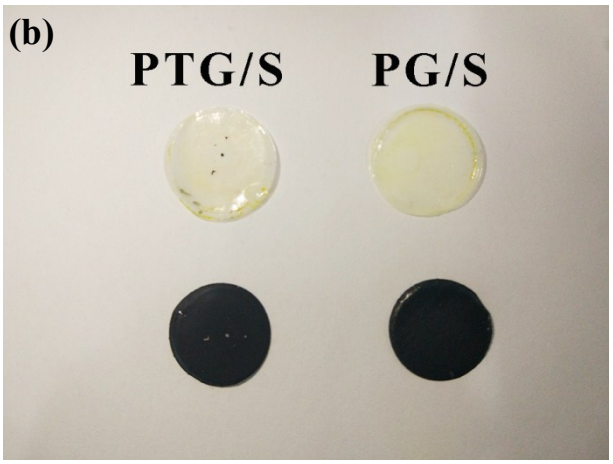


Fig. S8 Optical images of separators in the PTG/S and PG/S cells: (a) front side of the separator facing the cathode ; (b) back side of the separator.

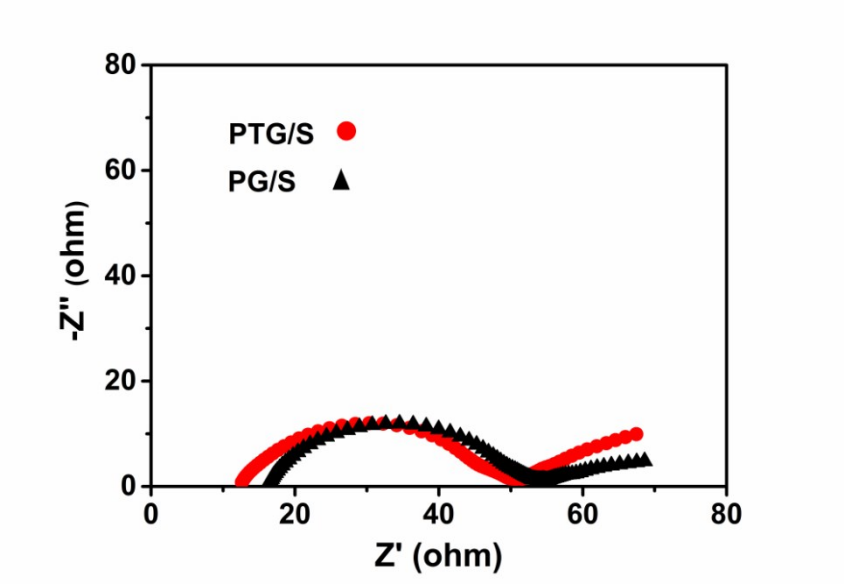


Fig. S9 Nyquist plots of fresh PG/S and PTG/S cathodes.

Table S1 Elemental compositions of PG and PTG composite.

	Ti	**N**	**C**	**O**
PG	-	9.0%	86.4%	4.5%
PTG	1.64%	4.6%	88.6%	5.2%

Table S2 Impedence parameters of PG/S and PTG/S composites before and after 100 and 200 cycles.

Cycle	**PG/S** (Ω)			**PTG/S** (Ω)		
	R_o	R_s	R_{ct}	R_o	R_s	R_{ct}
0	15.6	-	33.4	12.2	-	35.2
100	3.5	-	35.9	6.1	4.9	14.86
200	4.5	-	47.3	10.6	5.0	24.9