A macro-porous graphene oxide-based membrane as a separator with enhanced thermal stability for high-safety lithium-ion battery

*Haiyang Liao, [a] Haiyan. Zhang, [a, b *] Haoqun Hong [a, b] Gai Qin [a] Zhenghui Li [a, b] Liuqing Li, [a]*

[a] School of Materials and Energy, Guangdong University of Technology, Guangzhou 510006, China; * E-mail: hyzhang@gdut.edu.cn (HY. Zhang); Fax: +86 20 39322570;

[b] Guangdong Provincial Key Laboratory of Functional Soft Condensed Matter, Guangdong University of Technology, Guangzhou 510006, China.

Supporting Information:

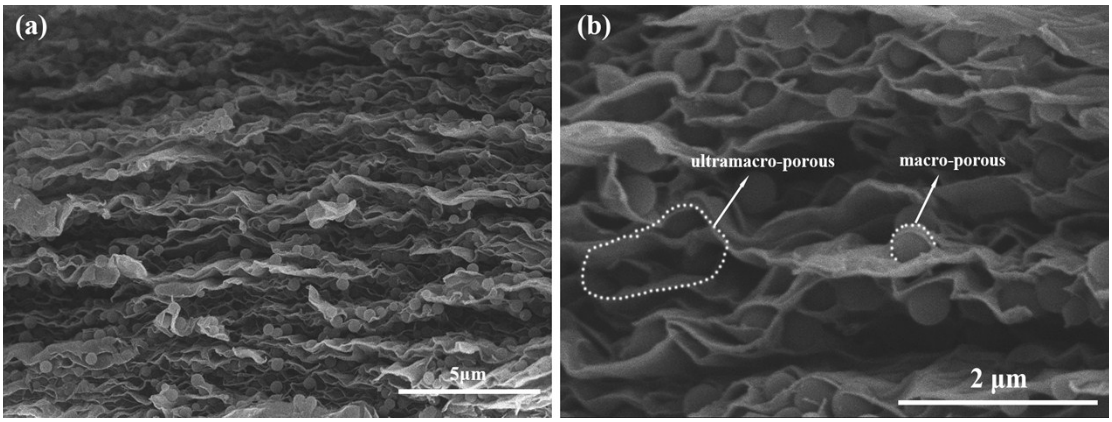

Fig. S1 SEM image of cross-section of GO-g-HBPE membrane before extracting the PS templates, (a) low magnification (b) high magnification.

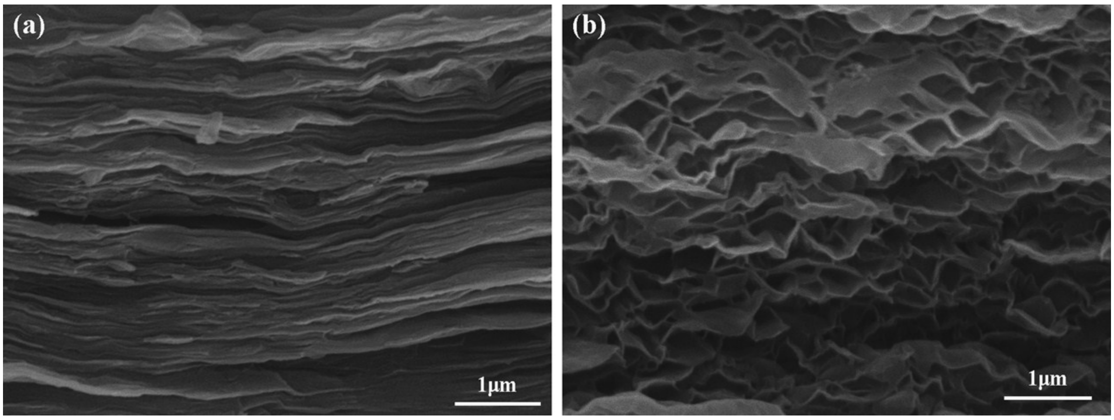

Fig. S2 SEM image of cross-section of pure GO and macroporous GO membranes.

Table S1 The atomic concentration determined by XPS

Element	Atomic Concentration (%)	
	GO	GO-g-HBPE
C	55.68	63.84
O	41.32	34.55
N	1.12	0.37
S	1.01	0.07
Si	0.55	0.94
Cl	0.23	0.23

Table S2 Membrane properties of a commercial PP separator and GO-g-HBPE separator

	Porosity (%)	Electrolyte uptake (%)	Ionic conductivity (mS/cm)	t+
PP separator	39	103	0.47	0.26
GO-g-HBPE separator	58	158	1.7	0.58
GO separator	16	23	0.07	0.11
Macroporous GO separator	55	68	0.28	0.18

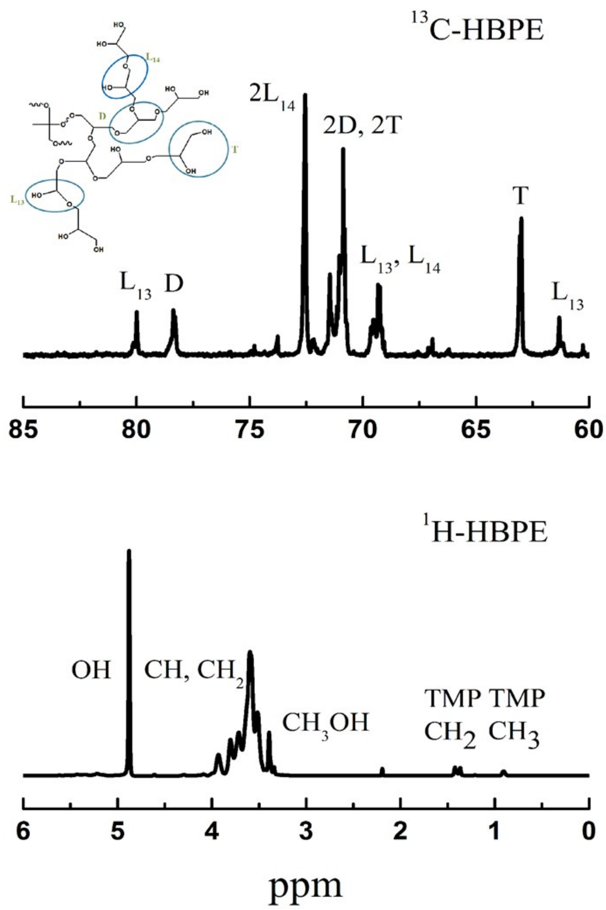

Fig S3 ^{1}H- and ^{13}C-NMR spectra of HBPE; carbons belonging to the terminal, dendritic, linear 1, 3 and linear 1, 4 groups are indicated by T, D, L_{13} and L_{14}; T, D, L_{13} and L_{14} are respectively represent terminal (T), dendritic (D), linear 1, 3 (L_{13}) and linear 1, 4 (L_{14}) groups.

200 °C for 0.5 h.

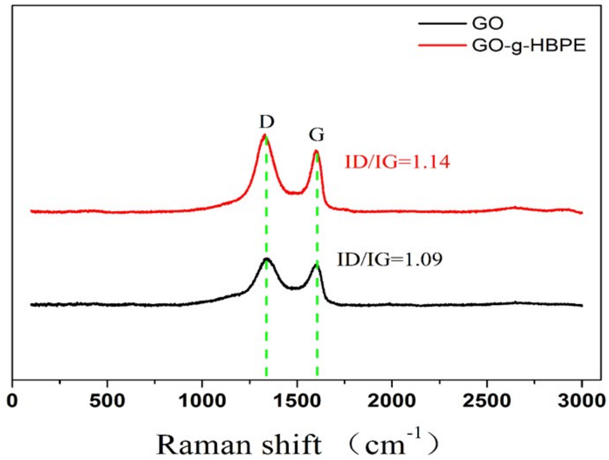

Fig. S4 Roman spectra of GO and GO-g-HBPE

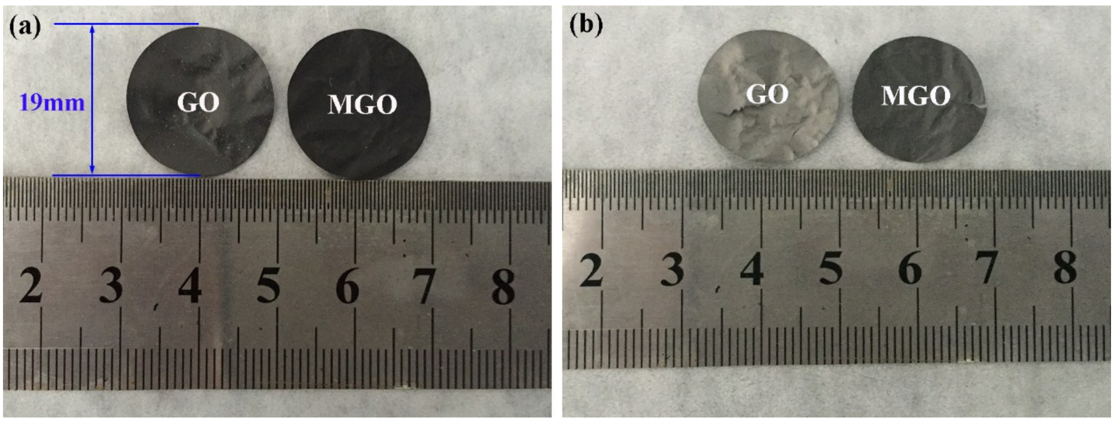

Fig. S5 Photographs of the GO and MGO separators (a) before and (b) after heating to 200 °C for 0.5 h.

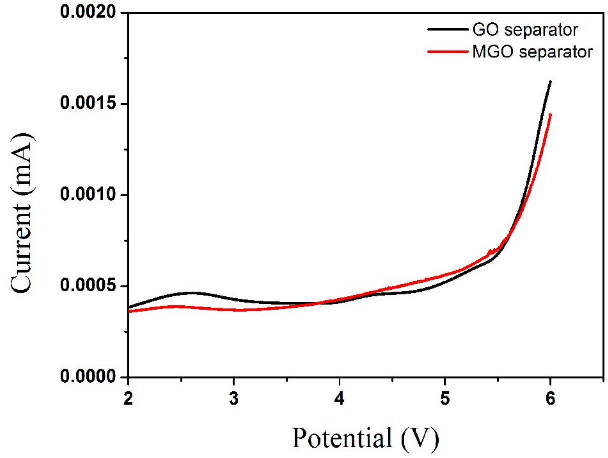

Fig. S6 Electrochemical working window of pure GO and MGO separator.

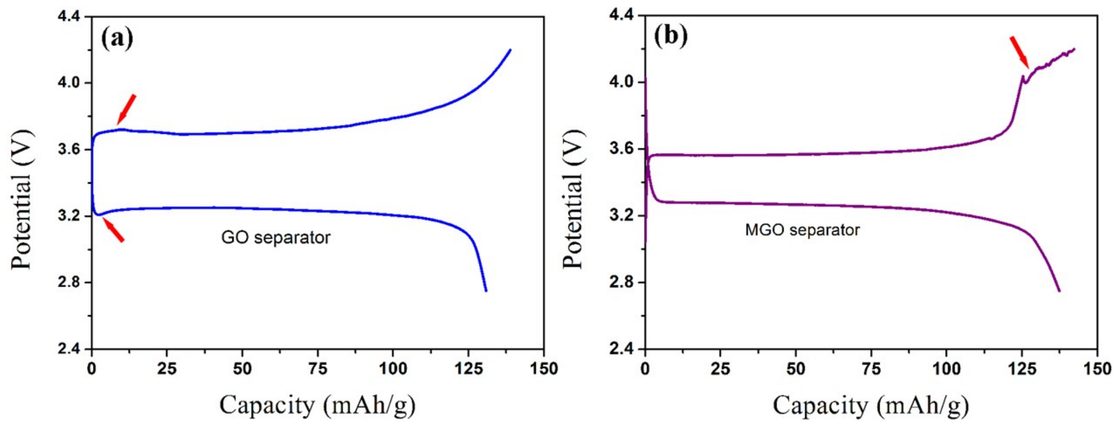

Fig. S7 Charge-discharge performance of (a) pure GO separator and (b) MGO separator.