†Electronic Supplementary Information (ESI) available. See DOI: 10.1039/b000000x/

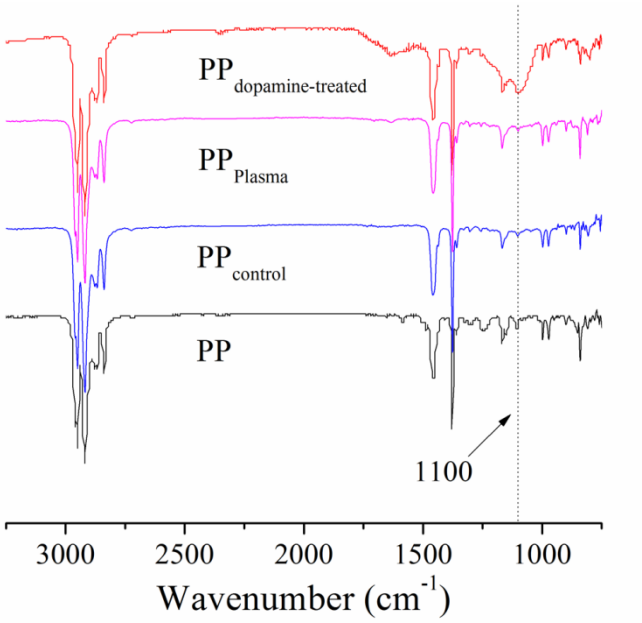

Fig. S1. ATR-FTIR spectra of separators with different treatment conditions.

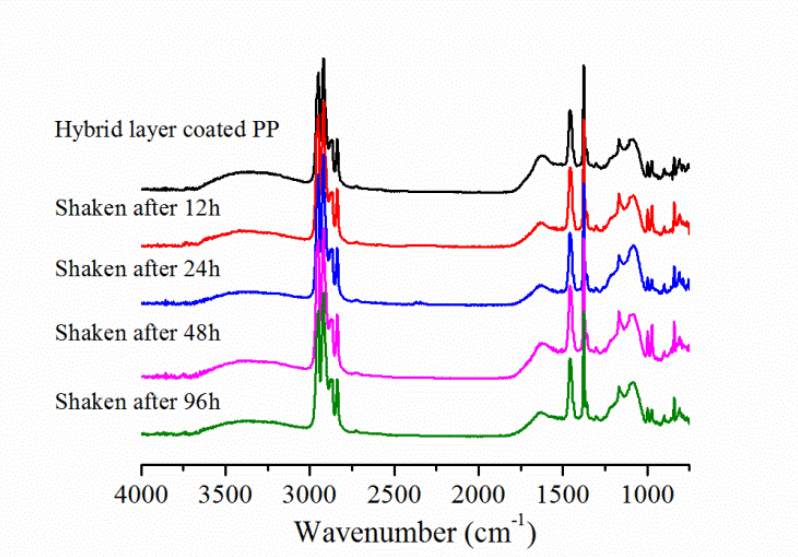

Fig. S2. The ATR-FTIR spectra of hybrid layer coated PP (*COI* 10.2%) and the separators shaken after 12h, 24h, 48h and 96h, respectively.

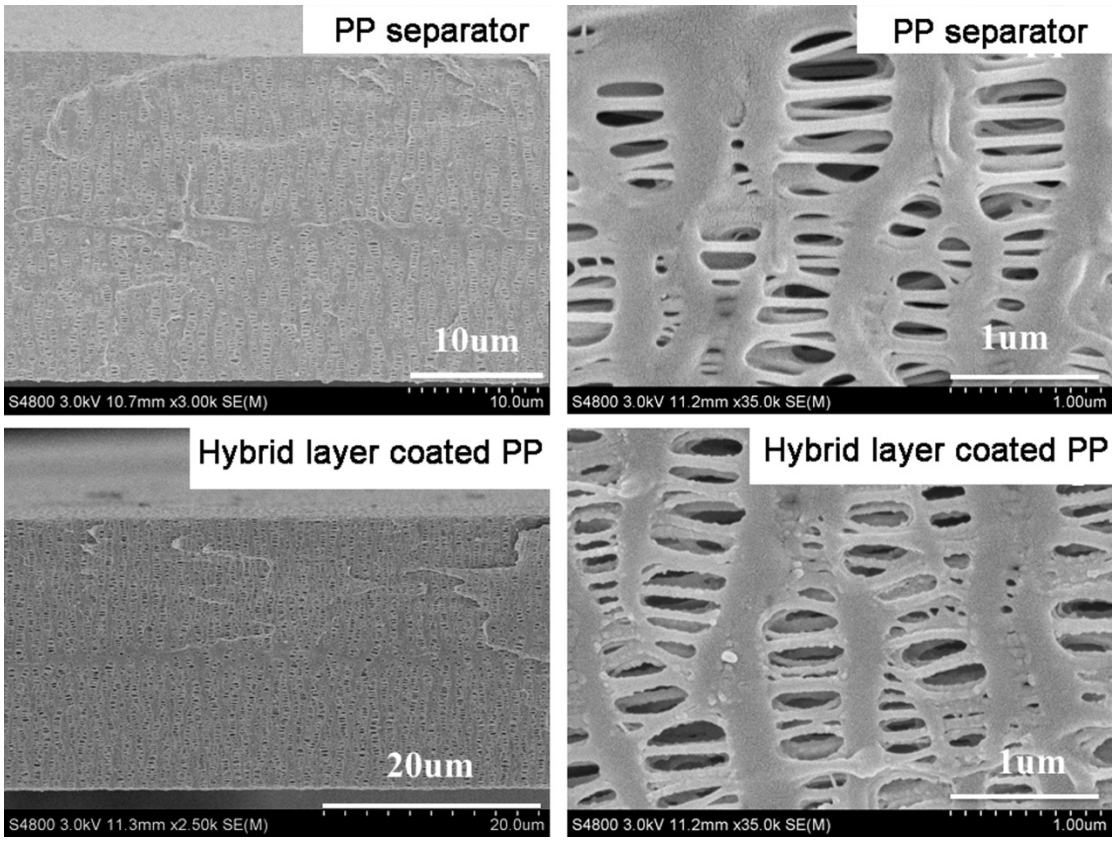

Fig. S3. The cross-section morphologies of the unmodified PP separator and hybrid layer coated PP (*COI*: 11.9%) with different magnifications.

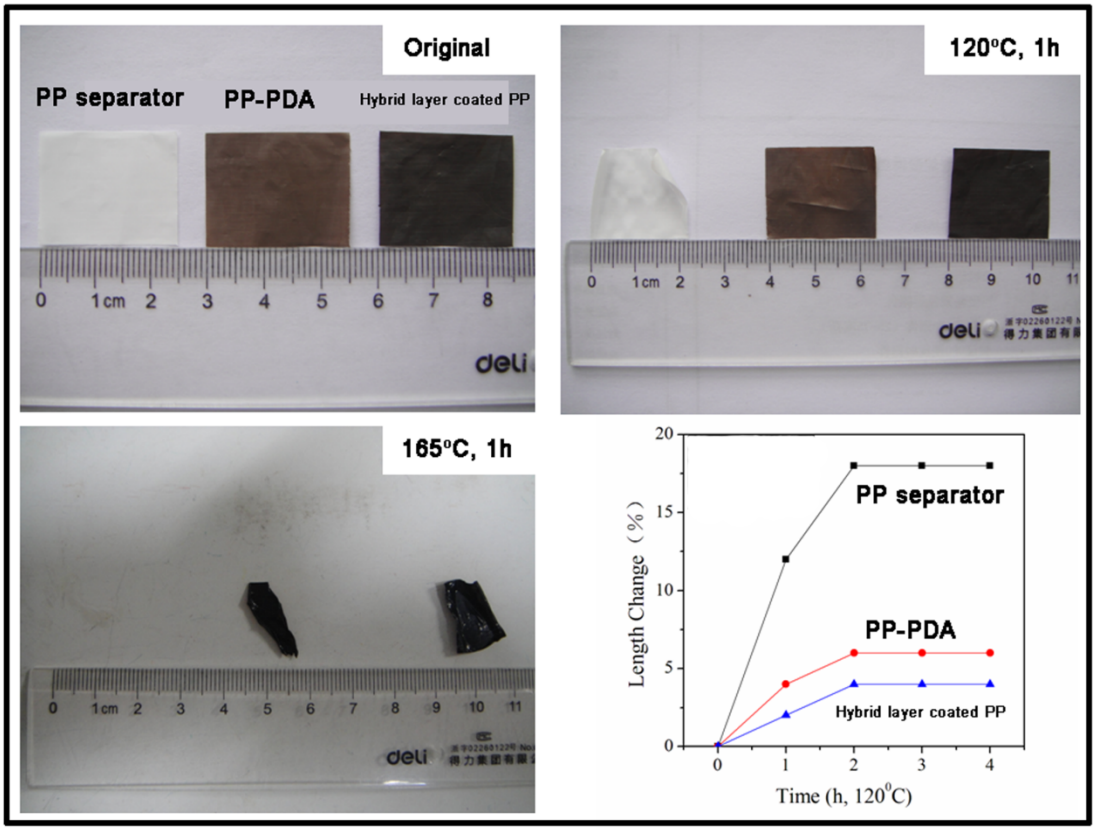

Fig. S4. Comparison of thermal stability of PP separator, PP-PDA and hybrid layer coated PP (*COI:* 11.9%).

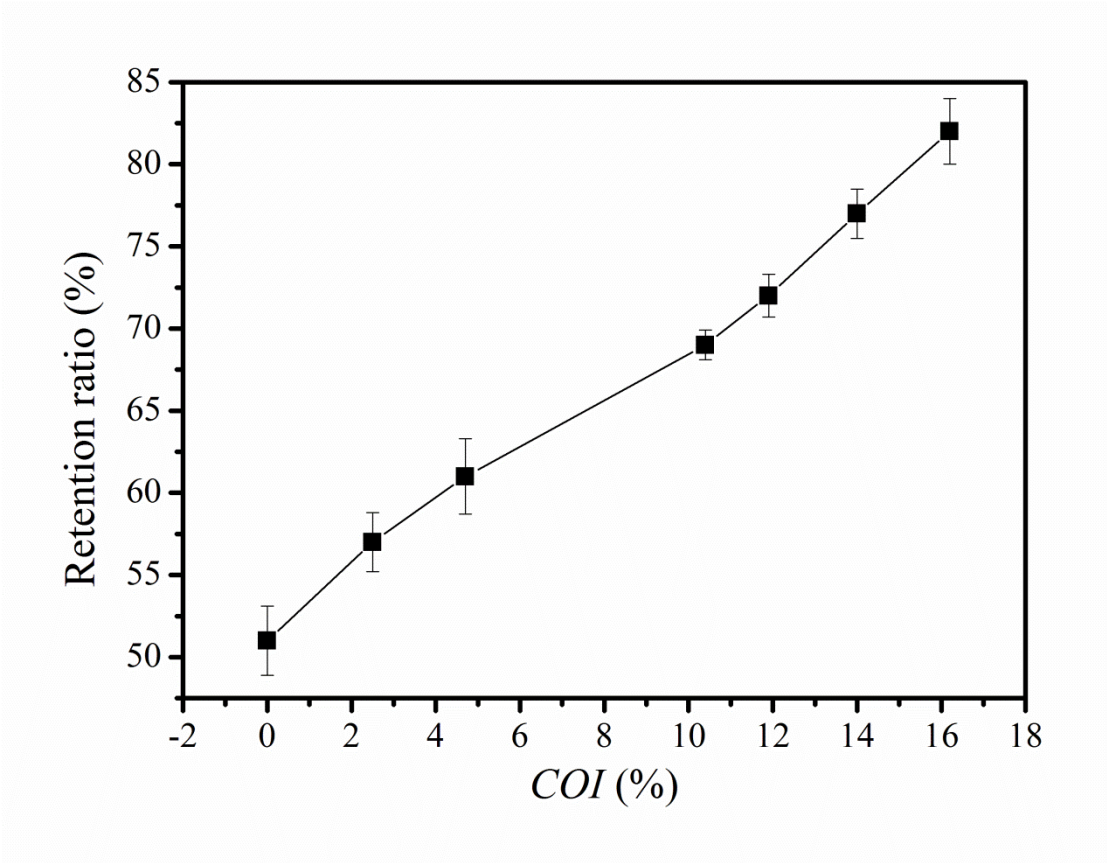

Fig. S4. The retention ratio of the liquid electrolyte for separators after being kept in the sample bags for 6 h.

Table S1

The absorbance at 1460cm^{-1} and 1100cm^{-1} of hybrid layer coated PP (*COI* 10.2%) and the separators shaken after 12h, 24h, 48h and 96h, respectively, according to the corresponding ATR-FTIR spectra

Sample ID	PH1460	PH1100	PH1100/PH1460
Hybrid layer coated PP	0.0218	0.0146	0.669
Shaken after 12H	0.0215	0.0146	0.679
Shaken after 24H	0.0184	0.0127	0.690
Shaken after 48H	0.0241	0.0170	0.705
Shaken after 96H	0.0203	0.0145	0.714

Table S2

The mechanical properties of PP separator, hybrid layer coated PP (*COI* 11.9%) and plasma treated PP separator

Separator	Tensile strength (MPa)	Elongation (%)
PP	128.5	76.5
Hybrid layer coated PP	150.1	96.0
Plasma treated PP	110.0	30.6