Supporting Information for

An interpenetrating network poly(diethylene glycol carbonate) based polymer electrolyte towards solid state lithium batteries

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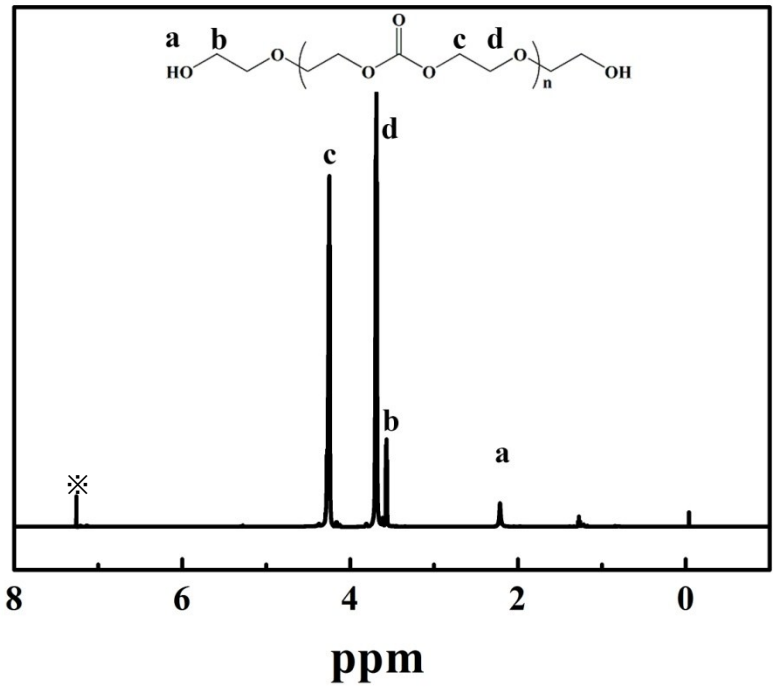


Fig. S1. ^{1}H NMR spectra of PDEC in $CDCl_3$.

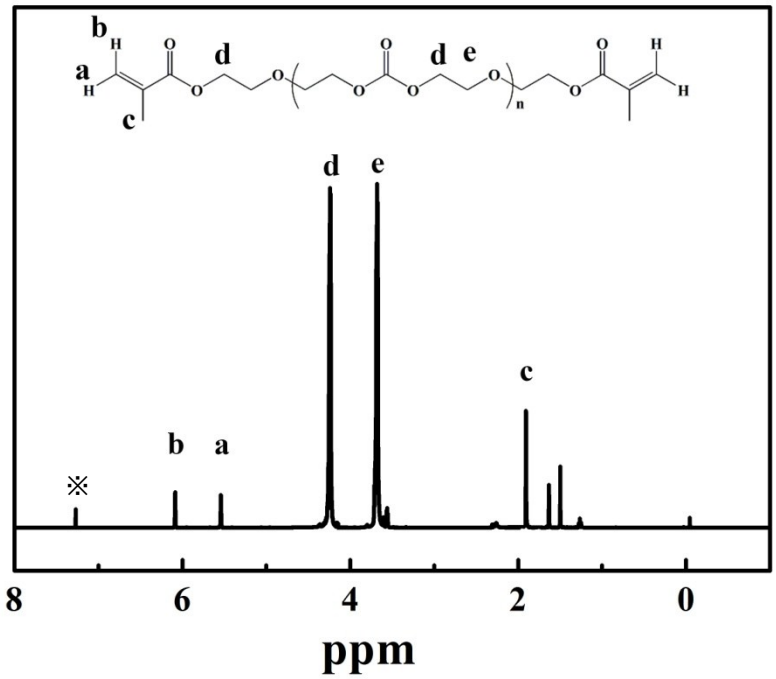


Fig. S2. ^{1}H NMR spectra of PDEC-DMA in $CDCl_3$.

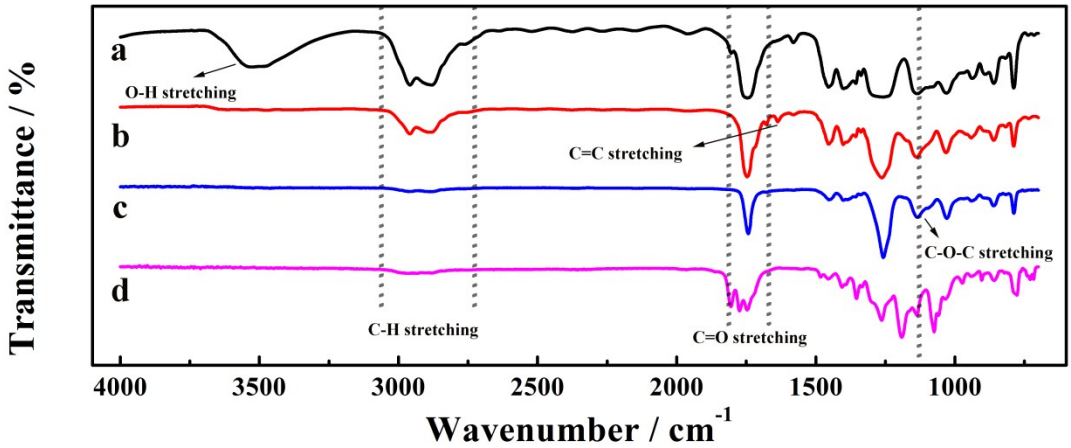


Fig. S3. FTIR spectra of (a) PDEC, (b) PDEC-DMA; ATR-FTIR spectra of (c) IPN-PDEC, (d) IPN-PDEC-LiTFSI$_{20}$.

Tab. S1. Analysis of FT-IR spectrum

Wavenumber / cm^{-1}	**Analysis**
3535	stretching vibration of hydroxyl
2872-2872	stretching vibration of C-H
1756	stretching vibration of C=O from carbonate and methacrylate
1634	stretching vibration of C=C from methacrylate
1396-1456	bending vibration of CH_2
1259	stretching vibration of C-O from carbonate and methacrylate
1128	stretching vibration of C-O-C from ether
786	bending vibration of O=C-O from carbonate

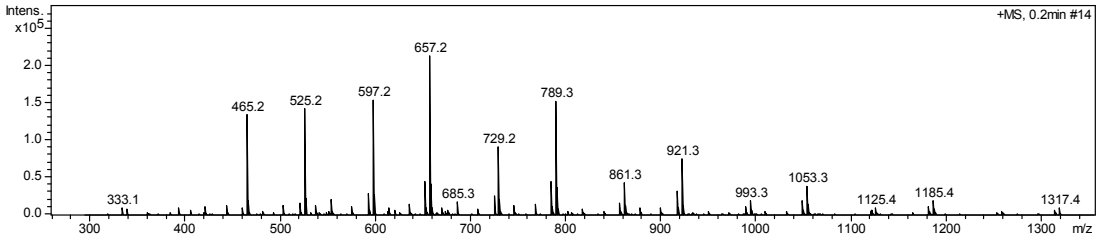
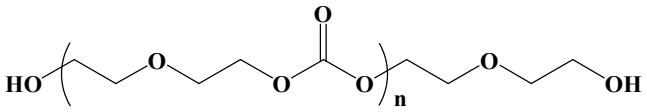
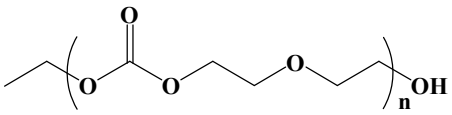


Fig. S4. ESI-MS distribution of PDEC.

Tab. S2. ESI-MS data analysis of PDEC.

Type Ⅰ:								
n	2	3	4	5	6	7	8	9
m/z	393	525	657	789	921	1053	1185	1317
Type Ⅱ:								
n	2	3	4	5	6	7	8	9
m/z	333	465	597	729	861	993	1125	1257

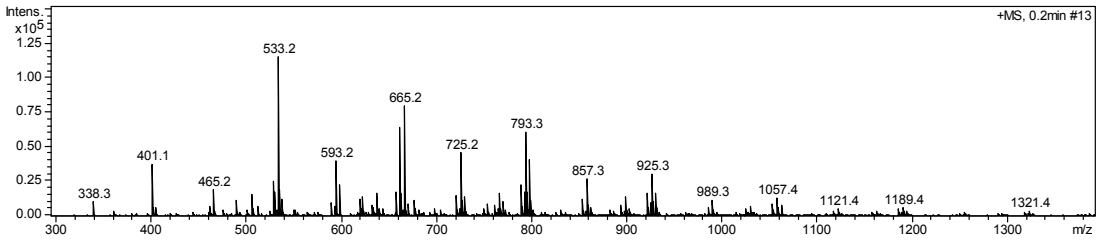
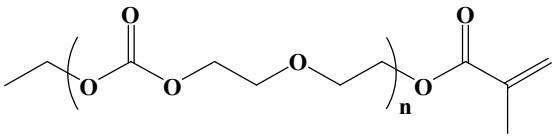
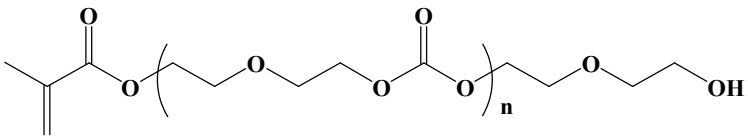
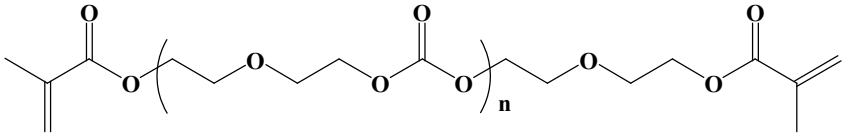


Fig. S5. ESI-MS distribution of PDEC-DMA.

Tab. S3. ESI-MS data analysis of PDEC-DMA.

Type Ⅰ:					
n	2	2	4	5	6
m/z	401	533	665	797	929

Type Ⅱ:						
n	2	3	4	5	6	7
m/z	461	593	725	857	989	1121

Type Ⅲ:				
n	2	3	4	5
m/z	528	661	793	925

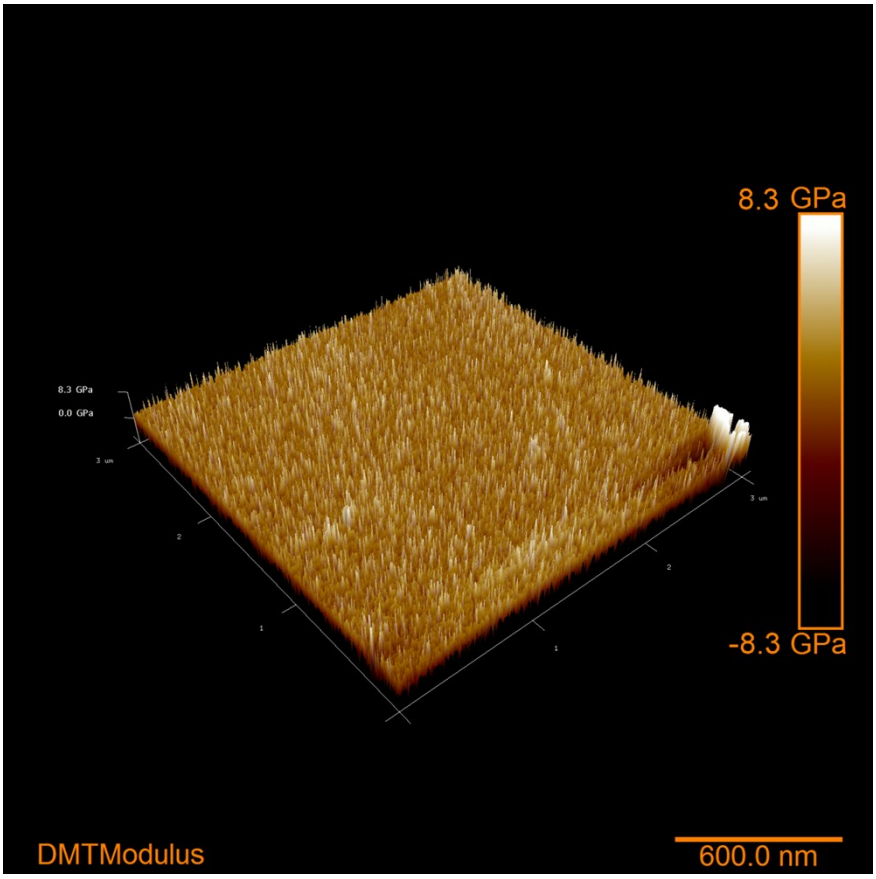


Fig. S6. Young' modulus mapping of the IPN-PDEC.

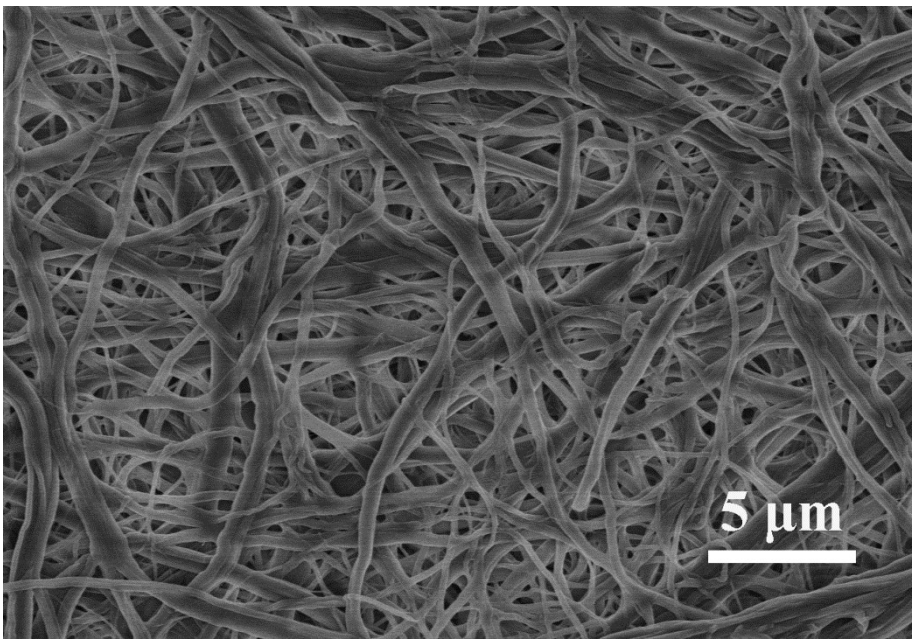


Fig. S7. The SEM image of pristine cellulose.

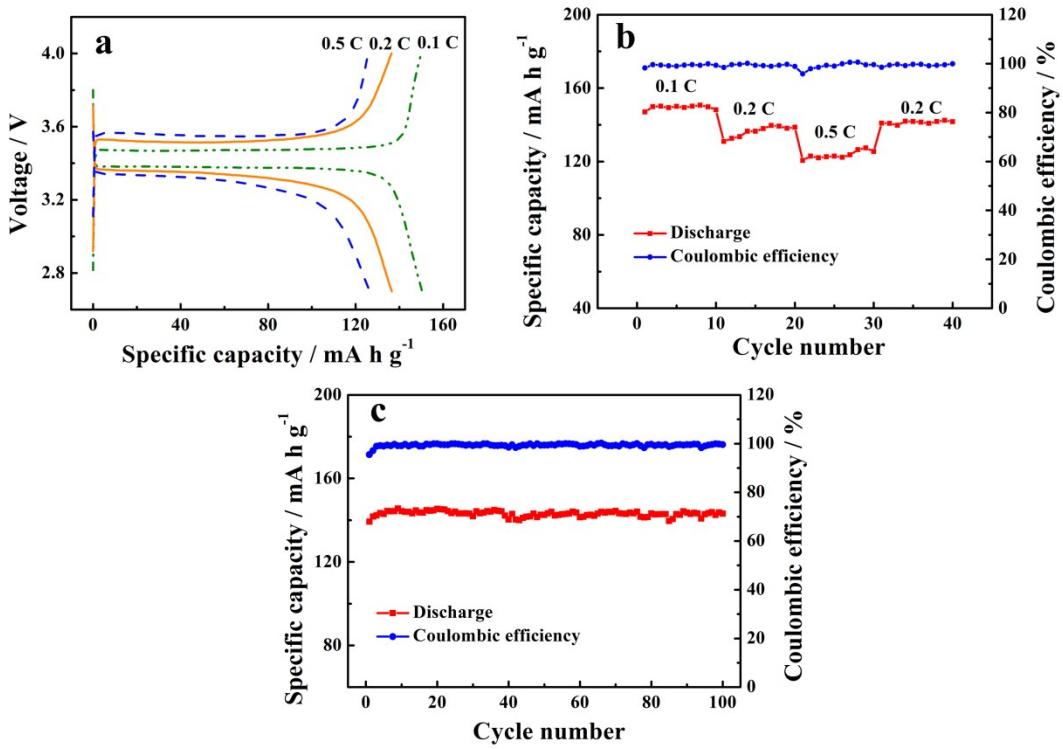


Fig. S8. (a) The charge/discharge profiles and (b) C-rate capability of $LiFePO_4$/IPN-PDEC-$LiTFSI_{20}$/Li cells with varied C-rates at 25 °C; (c) cycling performance of $LiFePO_4$/IPN-PDEC-$LiTFSI_{20}$/Li cells at a charge/discharge current intensity of 0.2 C and cut-off voltage of 2.75V to 4.0 V at 25 °C.

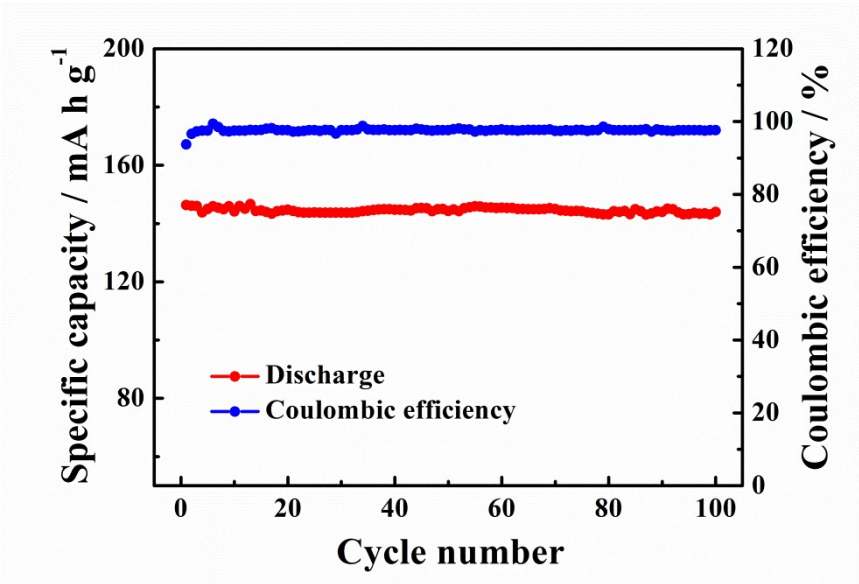


Fig. S9. The cycling performance of Li/cellulose+(1 M LiTFSI+EC/DMC)/LiFePO4 at a charge/discharge current intensity of 0.2 C and cut-off voltage of 2.75V to 4.0 V at 25 °C.

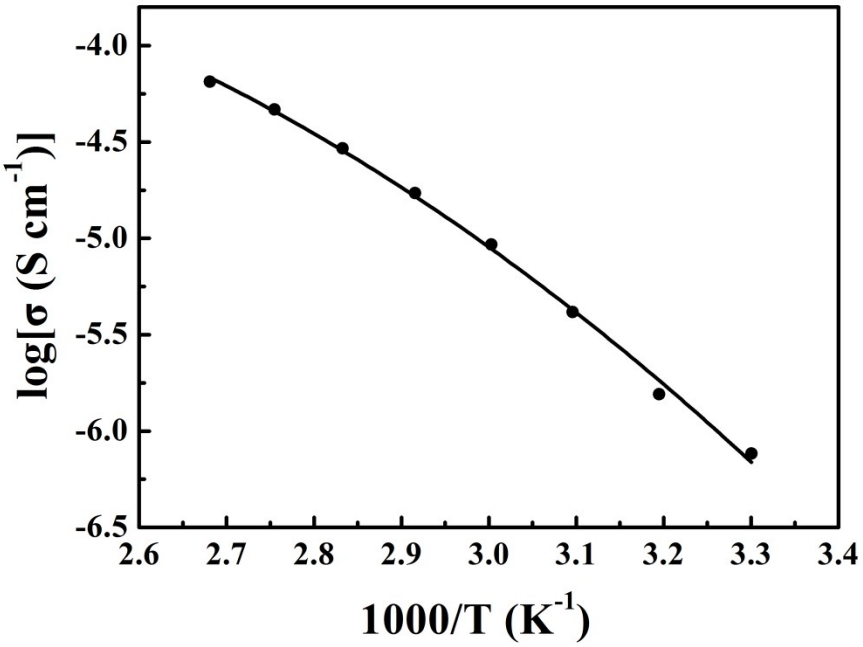


Fig. S10. Temperature of dependence of ionic conductivity of SPE-PDEC-$LiTFSI_{20}$.

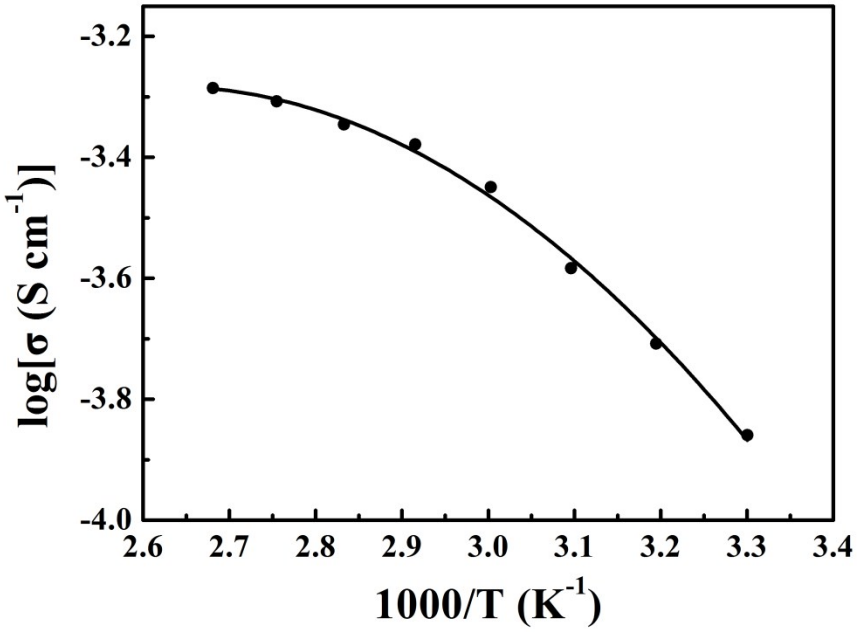


Fig. S11. Temperature dependence of ionic conductivity of IPN-PDEC-$LiDFOB_{15}$.