

Electronic Supplementary Information

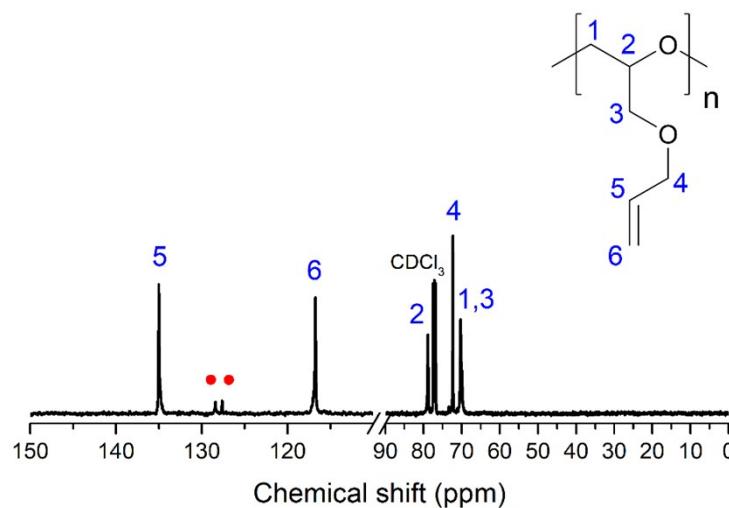


Figure S1 ^{13}C NMR of PAGE in CDCl_3 , red circles denotes peaks arising from the benzylic end groups.

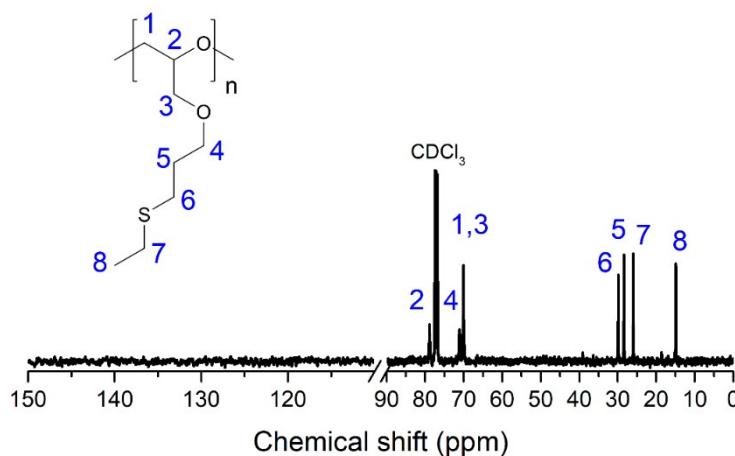


Figure S2 ^{13}C NMR of PEthioPGE in CDCl_3

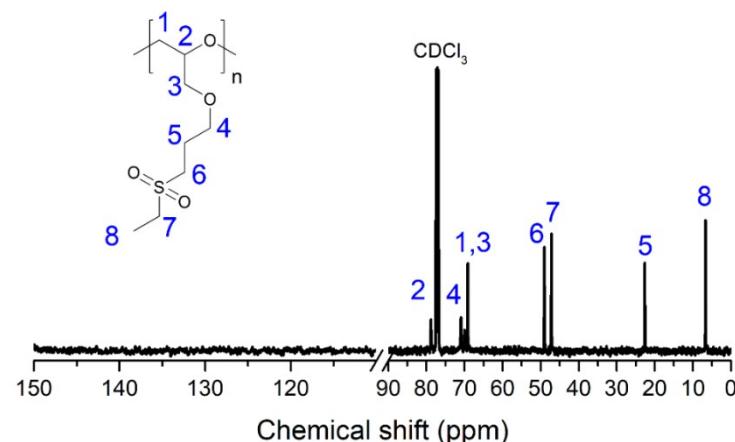


Figure S3 ^{13}C NMR of PEsulfoPGE in CDCl_3

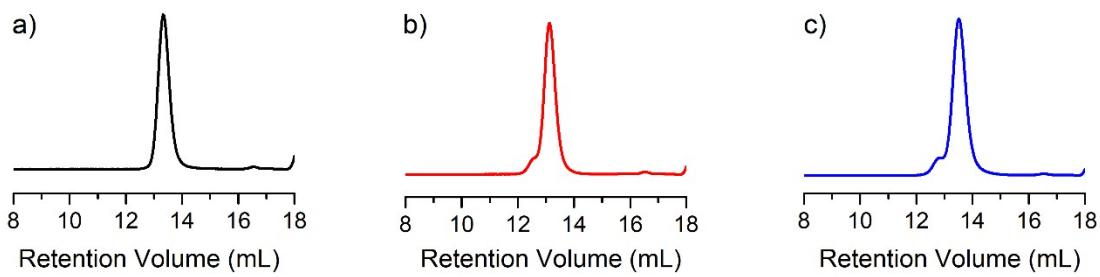


Figure S4 GPC traces of pure a)PAGE, b)PEthioPGE and c)PEsulfoPGE.

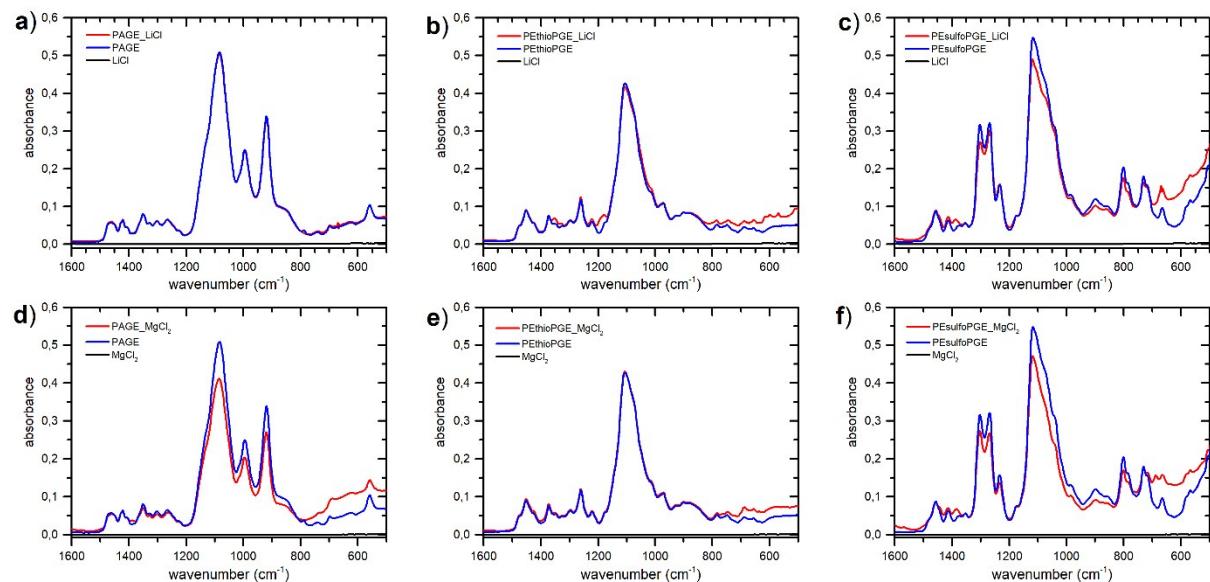


Figure S5 FTIR spectra of neat salt, neat polymer and electrolyte complex for a)PAGE-LiCl, b)PEthioPGE-LiCl, c)PEsulfoPGE-LiCl, d) PAGE- MgCl₂, e)PEthioPGE-MgCl₂ and f)PEsulfoPGE-MgCl₂

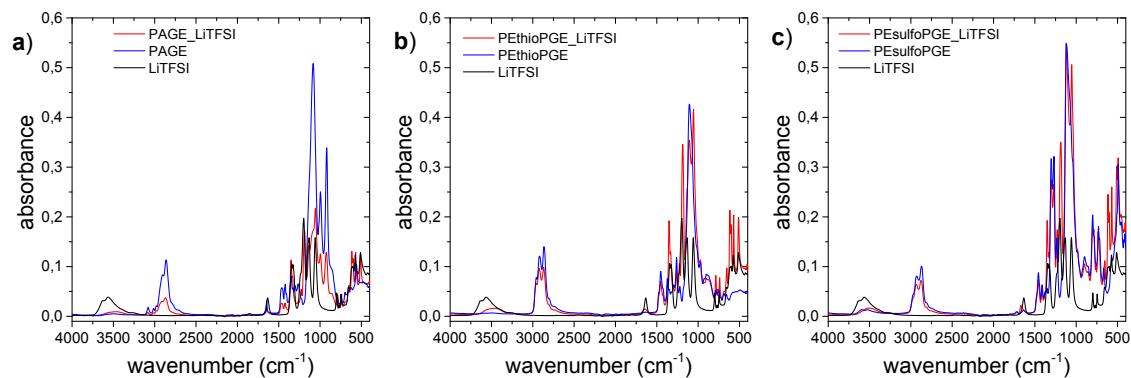


Figure S6 FTIR spectra of the LiTFSI complexes and their related components

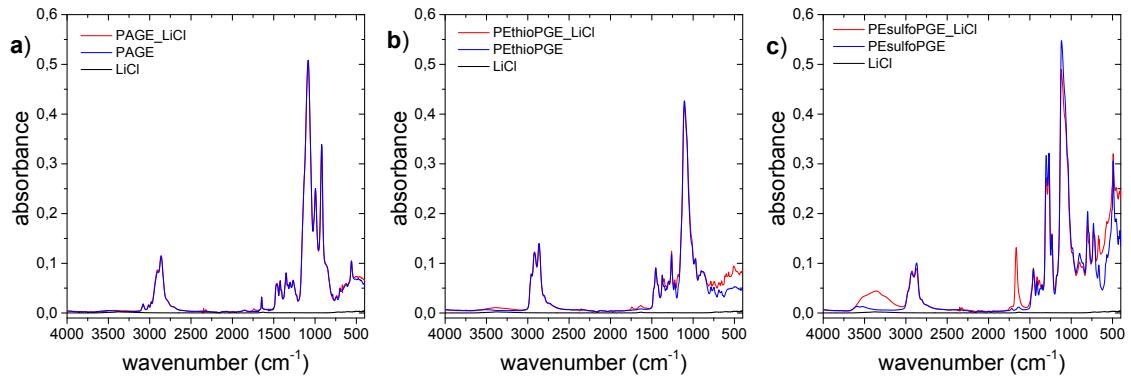


Figure S7 FTIR spectra of the LiCl complexes and their related components

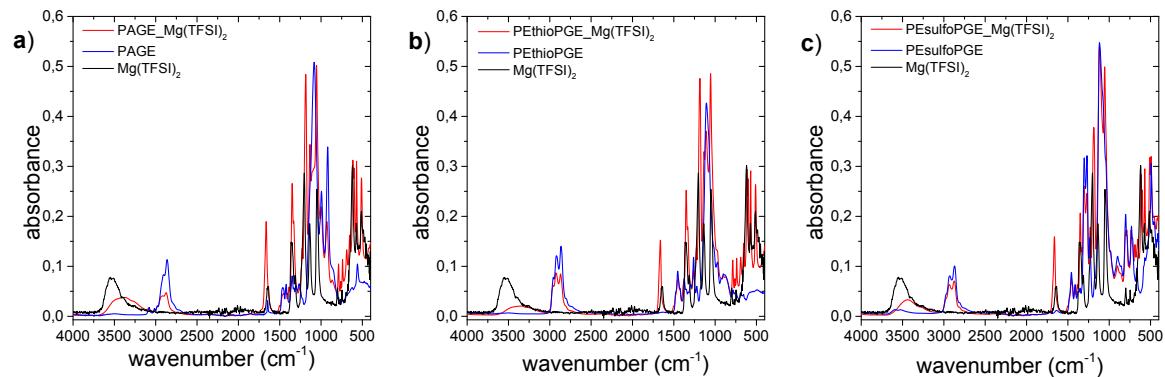


Figure S8 FTIR spectra of the Mg(TFSI)₂ complexes and their related components

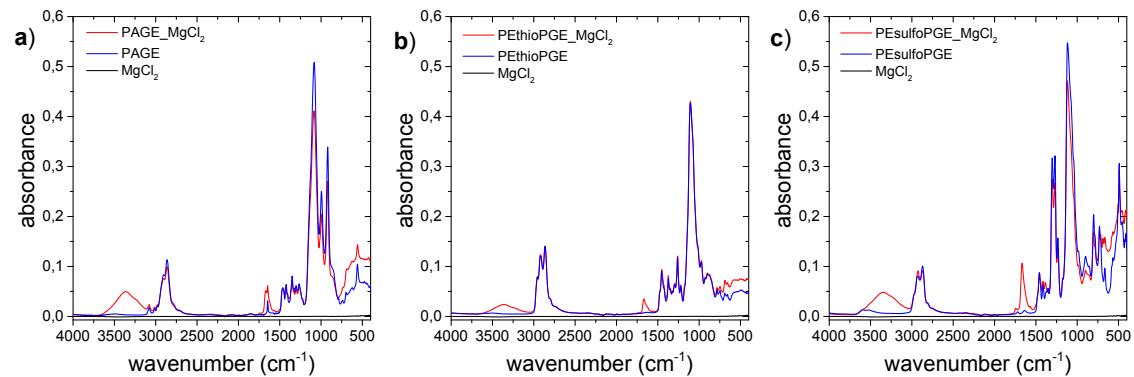


Figure S9 FTIR spectra of the MgCl₂ complexes and their related components

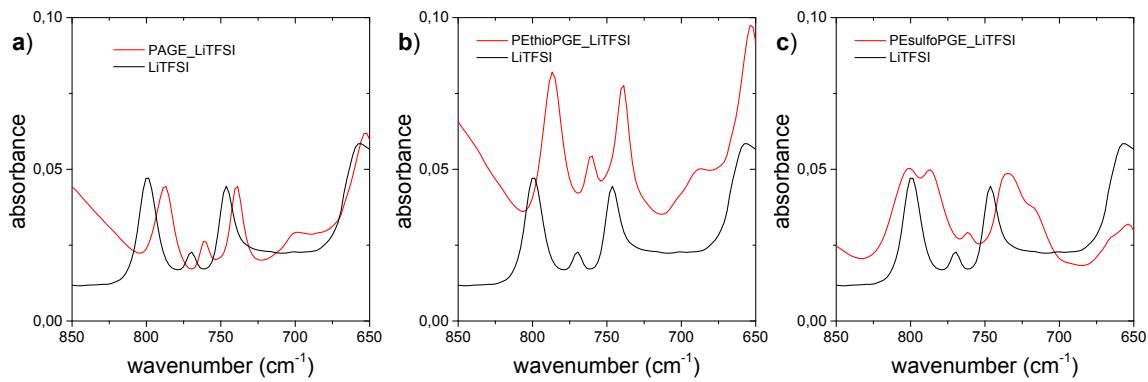


Figure S10 Comparison of the vibrational frequencies of TFSI anion in the polymer complex (red curves) compared with LiTFSI salt (black curves).

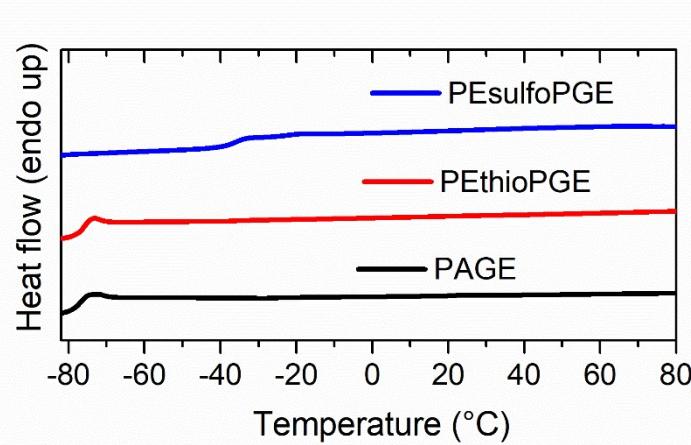


Figure S11 DSC curves for pure PAGE, PEthioPGE and PEsulfoPGE

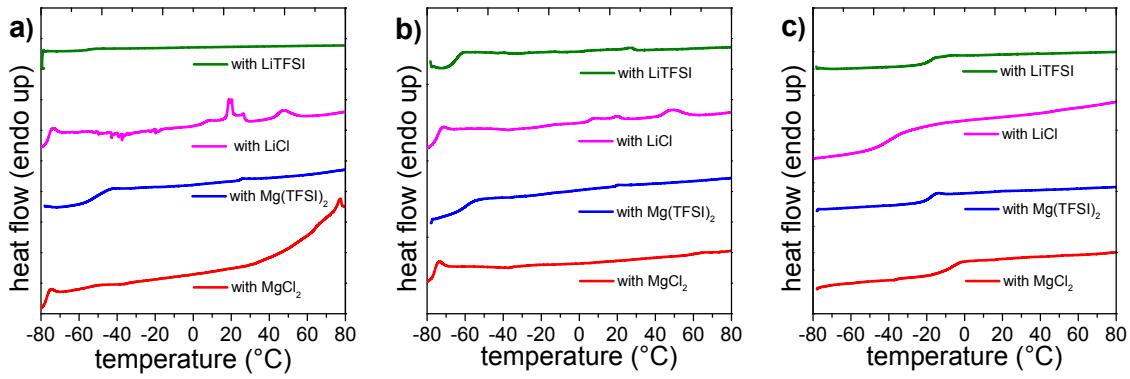


Figure S12 DSC curves for a) PAGE, b) PEthioPGE, c) PEsulfoPGE with different salts and same ration $r = [\text{Li}]/[\text{EO}] = 0.06$. The spurious signals found for the PAGE-LiCl and PEthioPGE-LiCl may be due to the very low solubility of the LiCl salt inside these two polymer host matrixes.

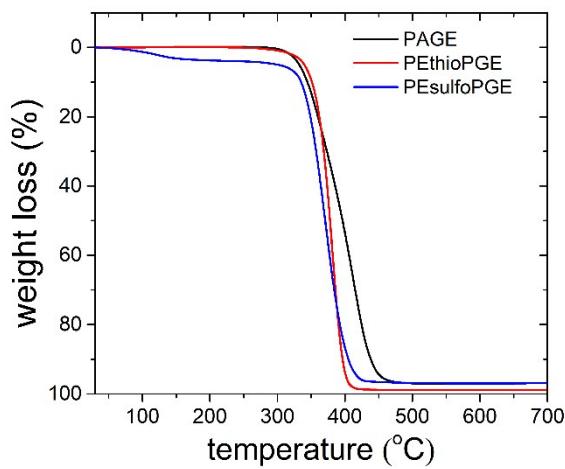


Figure S13 TGA in air of the neat polymers; heating rate 10K/min.

Table S1 Summary of the glass transition temperatures (T_g) of the polymer electrolyte complexes. Neat polymer T_g are reported for comparison

SALT	Tg from DSC (°C)		
	PAGE	PEthioPGE	PEsulfoPGE
NONE	-78	-76	-37
LiTFSI	-54	-64	-18
LiCl	-76	-74	-36
Mg(TFSI) ₂	-51	-59	-18
MgCl ₂	-77	-76	-10

Table S2 Summary of the thermal properties of the pristine polymers

T_d^a from TGA (°C)			T_g from DSC (°C)		
PAGE	PEthioPGE	PEsulfoPGE	PAGE	PEthioPGE	PEsulfoPGE
329	339	334	-78	-76	-37
Decomposition temperature was taken as the temperature corresponding to a 5% of weight loss. Glass transition temperature was taken at the inflection point of the DSC thermogram					

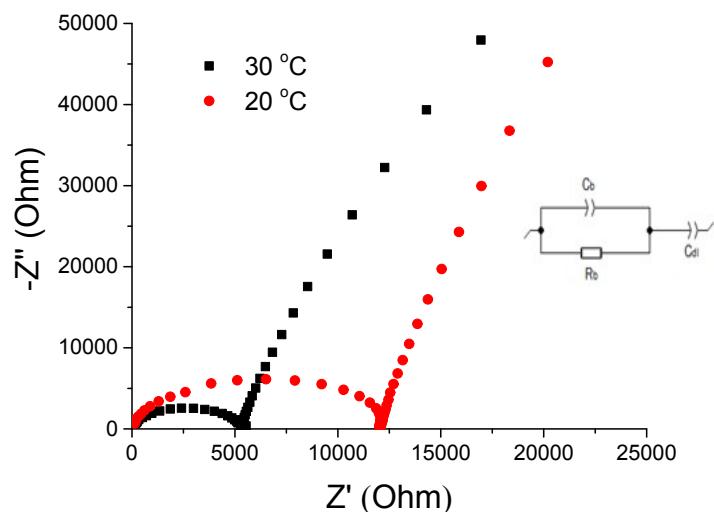


Figure S14 Typical Nyquist plot for the PAGE-Mg(TFSI)₂ at 20°C and 30°C. Inset shows the equivalent circuit used to fit the Nyquist curves and extract the bulk resistance

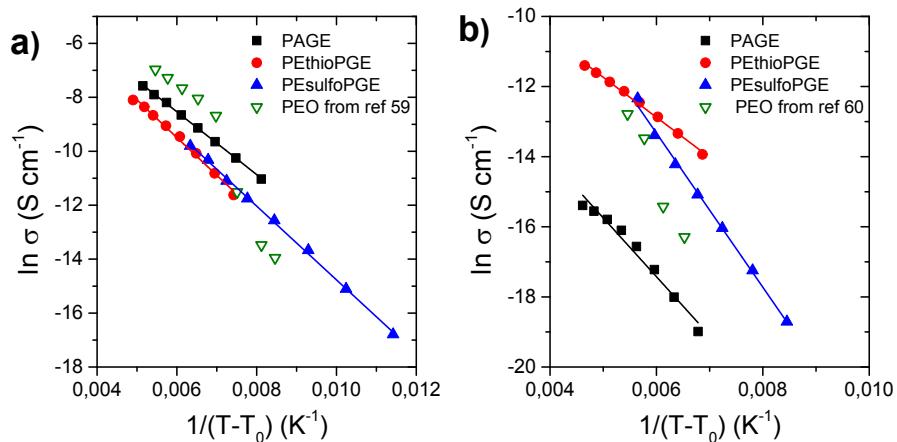


Figure S15 Vogel-Tamman-Fulcher plots for a) LiTFSI and b) LiCl polymer complexes. The available data for PEO-LiTFSI from ⁵⁹ and PEO-LiCl from ⁶⁰ are also reported in (a) and (b) respectively for comparison.

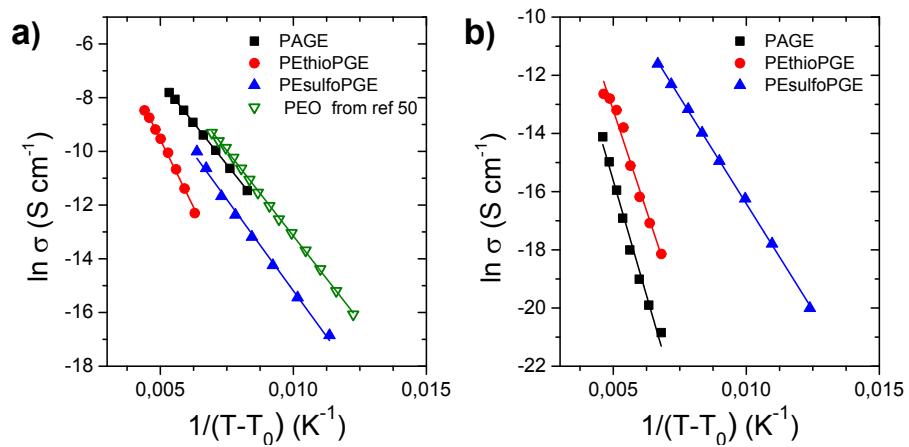


Figure S16 Vogel-Tamman-Fulcher plots for a) $\text{Mg}(\text{TFSI})_2$ and b) MgCl_2 polymer complexes. The available data for $\text{PEO}_9\text{-Mg}(\text{TFSI})_2$ from ⁵⁰ are also reported in (a) for comparison.