**Supporting Information**

# Effect of chemical structure and salt concentration on the crystallization and ionic conductivity of aliphatic polyethers

**By**

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## Solutions of polyethers in chloroform

Figure S1 show that P1 to P5 are completely soluble in chloroform. In the case of P6 the material is not completely soluble at room temperature (notice the cloudiness of the solution), for this reason the ionic conductivity has an out-of-trend behavior.

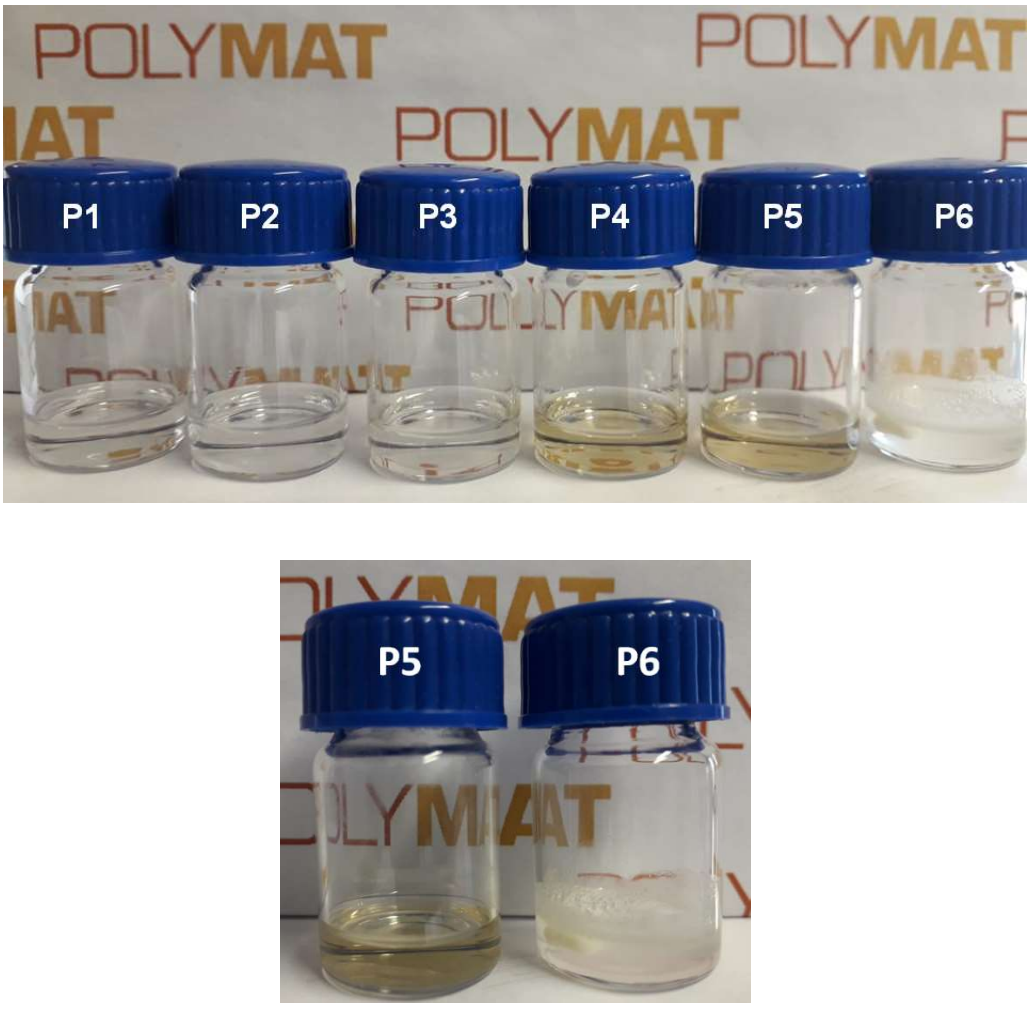
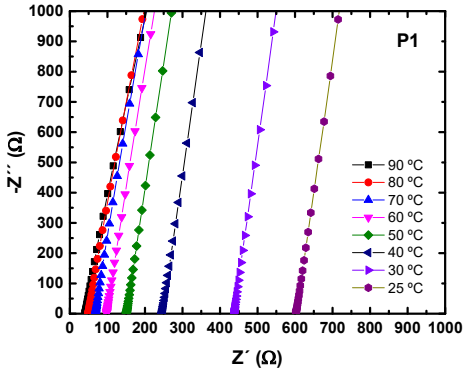
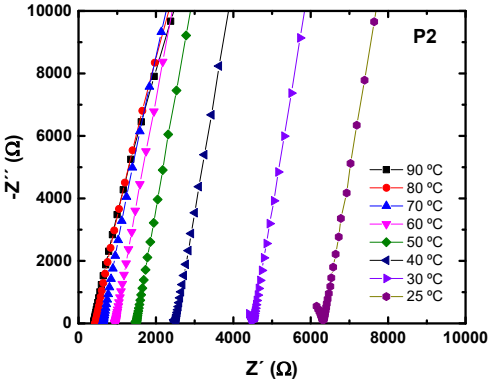
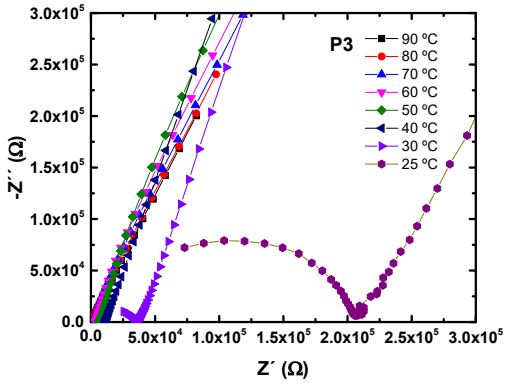


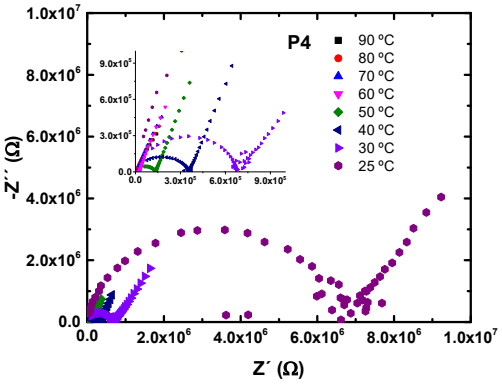

**Figure S1.** Photos of the solutions of the polyethers in chloroform.

**Electrochemical impedance spectroscopy (EIS)**


P1
90 ºC
80 ºC
70 ºC
60 ºC
50 ºC
40 ºC
30 ºC
25 ºC
-Z´´ (Ω)
Z´ (Ω)
0
100
200
300
400
500
600
700
800
900
1000


P2
90 ºC
80 ºC
70 ºC
60 ºC
50 ºC
40 ºC
30 ºC
25 ºC
-Z´´ (Ω)
Z´ (Ω)
0
2000
4000
6000
8000
10000


P3
90 ºC
80 ºC
70 ºC
60 ºC
50 ºC
40 ºC
30 ºC
25 ºC
-Z´´ (Ω)
Z´ (Ω)
0.0
5.0x10^4
1.0x10^5
1.5x10^5
2.0x10^5
2.5x10^5
3.0x10^5


P4
90 ºC
80 ºC
70 ºC
60 ºC
50 ºC
40 ºC
30 ºC
25 ºC
-Z´´ (Ω)
Z´ (Ω)
0.0
2.0x10^6
4.0x10^6
6.0x10^6
8.0x10^6
1.0x10^7

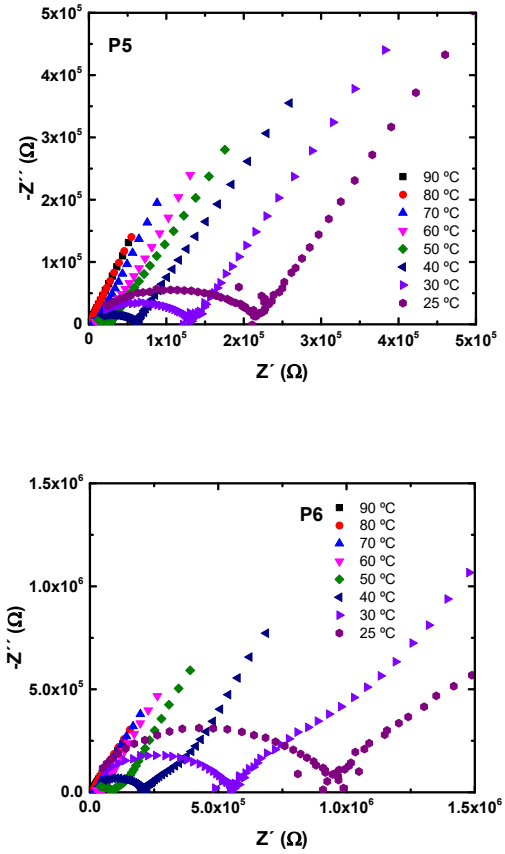



**Figure S2.** Nyquist plots of polyethers with 30 wt% LiTFSI.

## Hoffman- Weeks extrapolation

To perform the Hoffman-Weeks extrapolation, the samples were heated after isothermal crystallization from their $T_c$ values until melting and the peak melting temperature ($T_m$) were recorded. As an example, the Hoffman-Weeks plots for P3, P4, P5 and P6 are shown in the Figure S3. The straight line of the observed melting temperature against $T_c$ intersects with the equilibrium line (red line $T_m = T_c$) [1,2,3]. From the extrapolations, we estimated the $T_m^0$ values for all the samples.

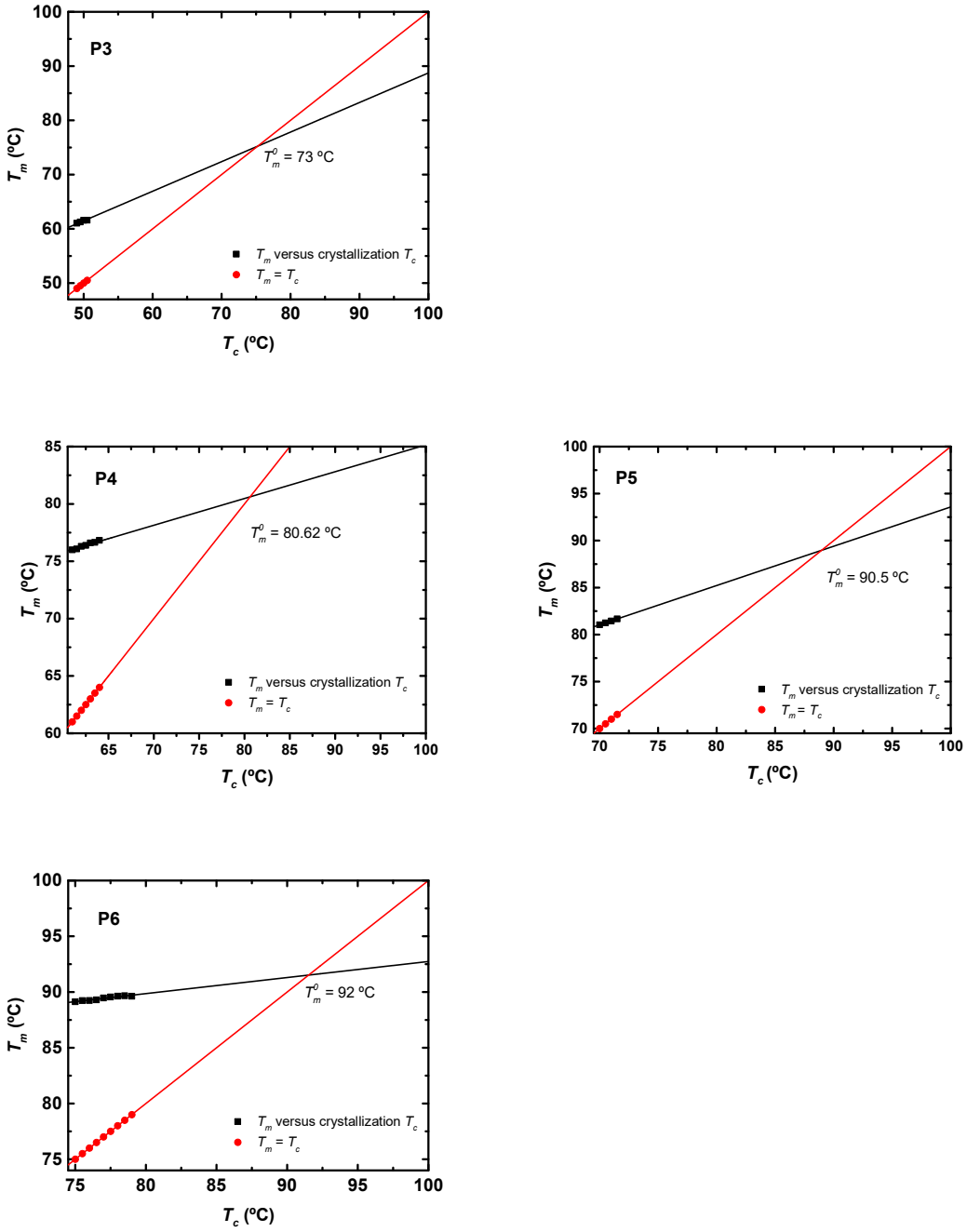



**Figure S3.** Hoffman- Weeks plots of neat polyethers

## Flory Huggins Theory

Table S1 shows the parameters used and the calculated values for SPE-P3 and SPE-5, after applying the Flory-Huggins theory.

**Table S1.** Calculated data for ($\upsilon_1/T_m$) x $10^3$ versus [($1/Tm - 1/T_m^0$)/$\upsilon_1$] x$10^3$

| Sample | $\upsilon_1$ | $T_m$ (K) | $T_m^0$ (K) | ($\upsilon 1/T_m$) x $10^3$ | [($1/Tm - 1/T_m^0$)/$\upsilon 1$] x$10^3$ |
|---|---|---|---|---|---|
| P3 5 wt% LiTFSI | 0.038 | 329.78 | 330.36 | 0.1154 | 0.1398 |
| P3 10 wt% LiTFSI | 0.077 | 329.61 | 330.64 | 0.2339 | 0.1225 |
| P3 20 wt% LiTFSI | 0.158 | 327.59 | 329.02 | 0.4830 | 0.0838 |
| P3 30 wt% LiTFSI | 0.248 | 321.22 | 322.31 | 0.7587 | 0.0432 |
| P5 5 wt% LiTFSI | 0.038 | 353.9 | 354.6 | 0.1075 | 0.1423 |
| P5 10 wt% LiTFSI | 0.077 | 353.16 | 354.2 | 0.2183 | 0.1336 |
| P5 20 wt% LiTFSI | 0.158 | 348.28 | 350.6 | 0.4843 | 0.1200 |
| P5 30 wt% LiTFSI | 0.248 | 345.73 | 348.73 | 0.7049 | 0.1021 |

Where $T_m$ is the apparent melting point, $T_m^0$ is the equilibrium melting temperature, $\upsilon_1$ is the volume fraction of LiTFSI, $\Delta H_u$ is the melting enthaply per mole of repeating unit [3].

## References


[1] A.T. Lorenzo, M.L. Arnal, J. Albuerne, A.J. Müller, DSC isothermal polymer crystallization kinetics measurements and the use of the Avrami equation to fit the data: Guidelines to avoid common problems, Polym. Test. 26 (2007) 222–231. doi:10.1016/j.polymertesting.2006.10.005.

[2] A.T. Müller, Alejandro J., Michell, R. M., Lorenzo, Isothermal Crystallization Kinetics of Polymers, in: Q. Guo (Ed.), Polym. Morphol. Princ. Charact. Process., John Wiley & Sons, 2016: pp. 181–203. doi:https://doi.org/10.1002/9781118892756.ch11.

[3] L. Mandelkern, Crystallization of Polymers, 2nd ed. Vo, Cambridge University Press, Cambridge, United Kingdom, 2002.