

Anion effects on the properties of OIPC/PVDF composites

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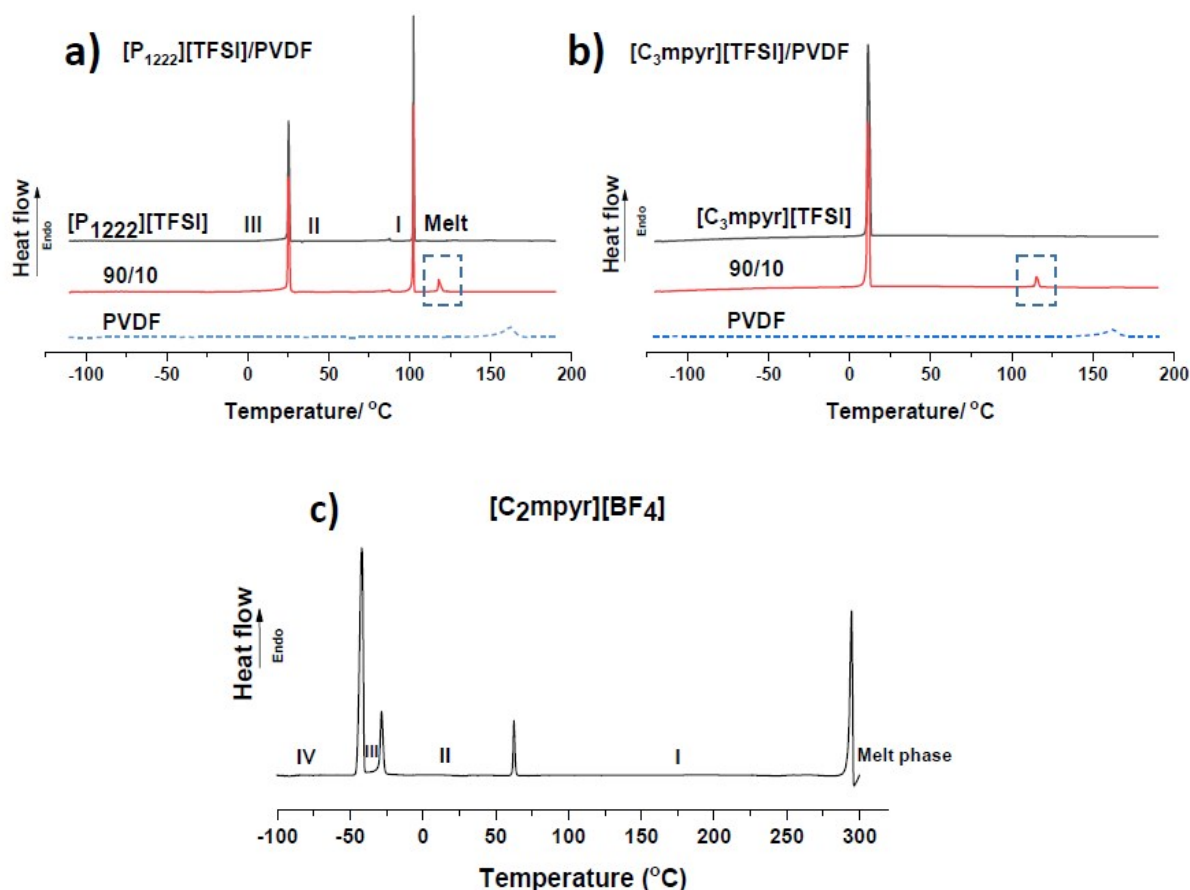


Figure S1; DSC heating scans highlighting the formation of new peaks for; a) [P₁₂₂₂][TFSI]/PVDF and b) [C₃mpyr][TFSI]/PVDF composites; c) DSC heating scan of [C₂mpyr][BF₄] showing melting peak at 293 °C

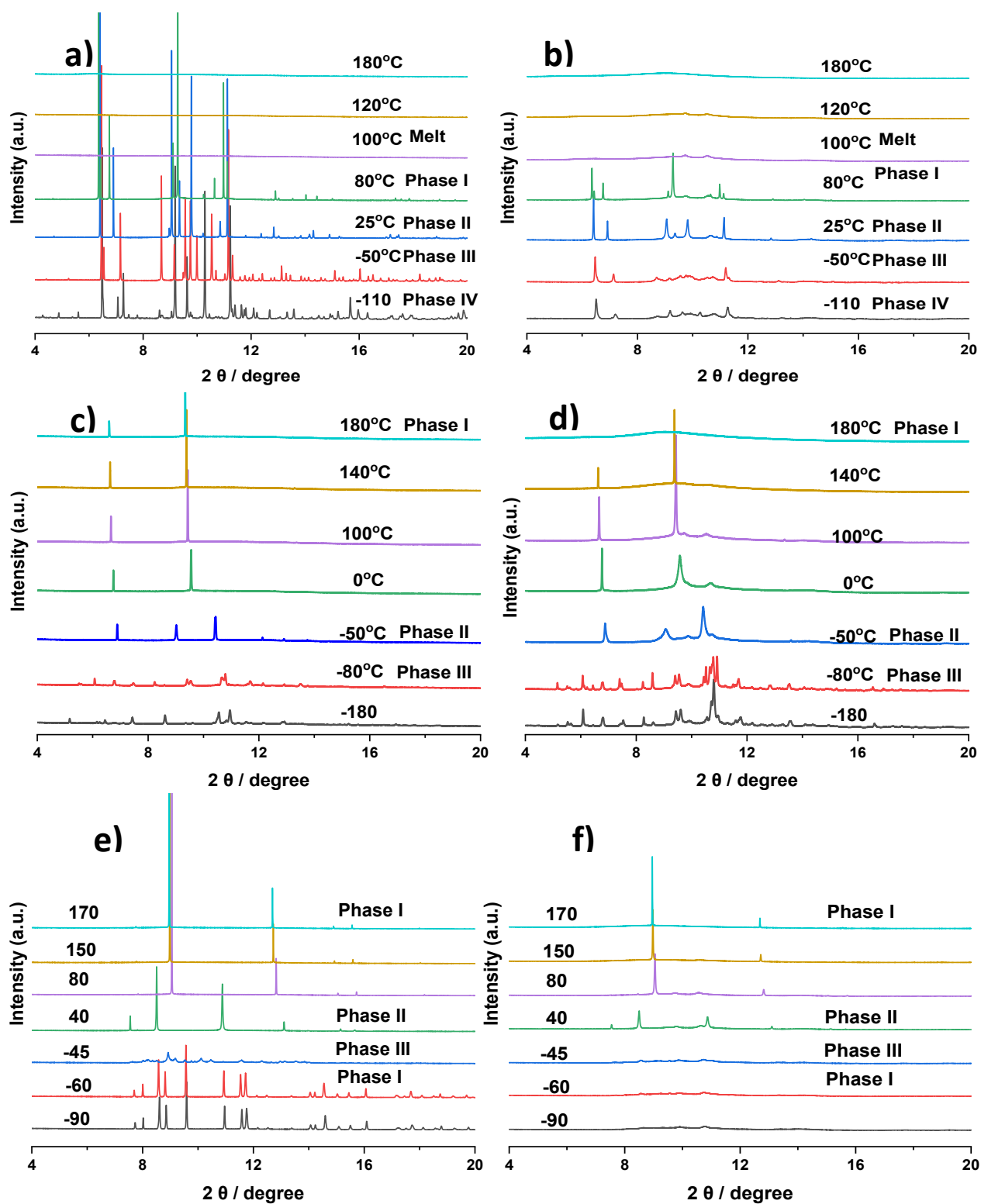


Figure S2: Synchrotron X-ray diffraction patterns recorded at different temperatures for; a. $[C_2mpyr][TFSI]$ b. $[C_2mpyr][TFSI]$ containing 50 vol% of PVDF; c. $[C_2mpyr][FSI]$; d. $[C_2mpyr][FSI]$ containing 50 vol% of PVDF ; e. $[C_2mpyr][BF_4]$; f. $[C_2mpyr][BF_4]$ containing 50 vol% of PVDF

Figure S2a and S2b show the synchrotron XRD pattern of [C₂mpyr][TFSI] and [C₂mpyr][TFSI]/PVDF composite (50/50) respectively. The materials progress from triclinic phase in phase IV to a monoclinic lattice system in phase II and to orthorhombic lattice system in phase I, all the while, becoming more symmetrical.^{1,2} Figure S2c and S2d show the synchrotron XRD pattern of the [C₂mpyr][FSI] and [C₂mpyr][FSI]/PVDF composite (50/50). The materials progress from monoclinic phase in phase III to a trigonal lattice system in phase II and to orthorhombic lattice system in phase I, all the while, becoming more symmetrical.³ Figure S2e and S2f show the synchrotron XRD pattern of the [C₂mpyr][BF₄] and [C₂mpyr][BF₄]/PVDF composite (50/50) which progress from monoclinic phase in phase IV to a trigonal lattice system in phase II and to cubic lattice system in phase I, all the while, becoming more symmetrical.⁴ Phase III appears to be a mixed phase containing multiple lattice systems.

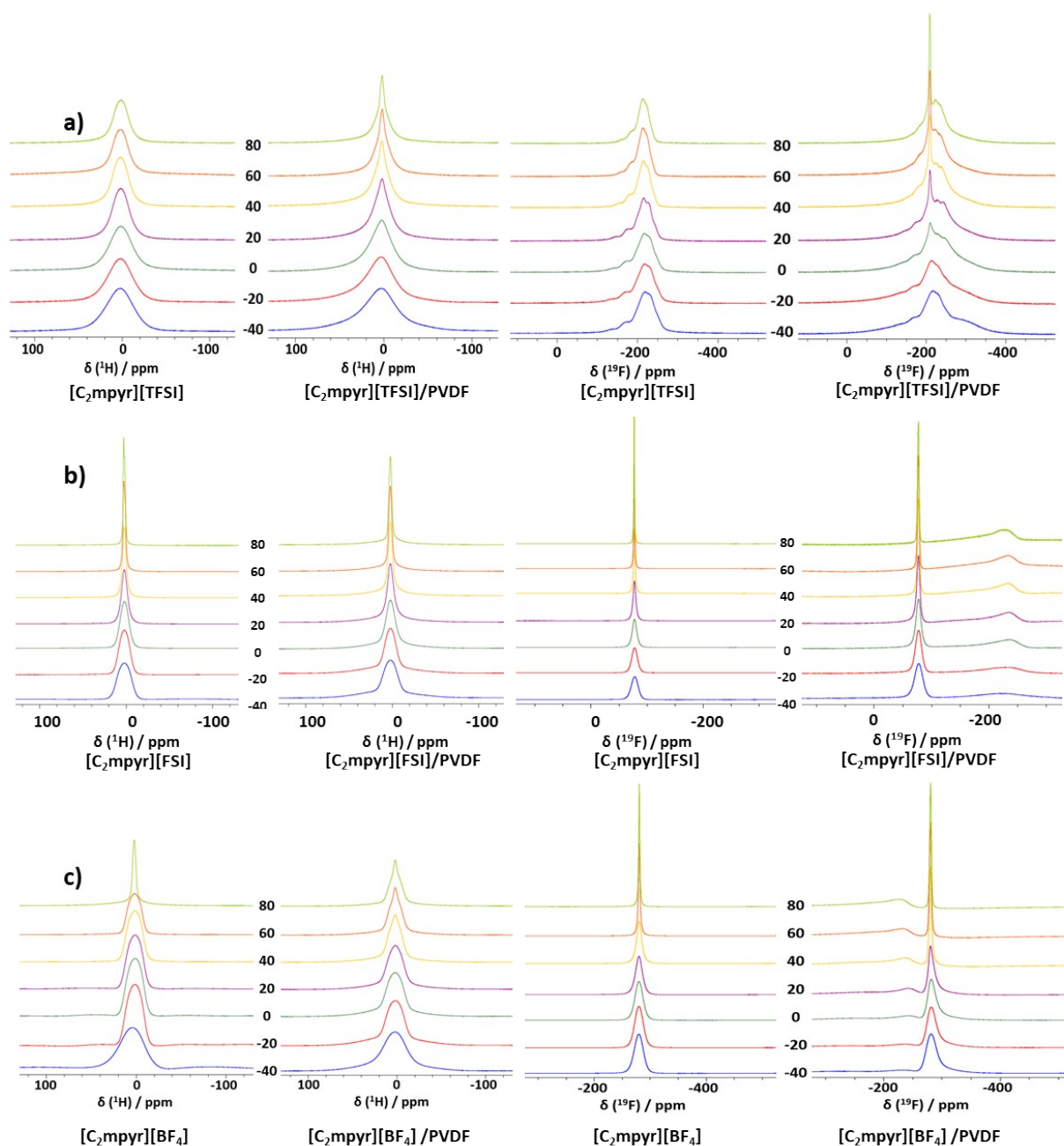


Figure S3: a. VT ^1H and ^{19}F spectra of $[\text{C}_2\text{mpyr}][\text{TFSI}]$ and $[\text{C}_2\text{mpyr}][\text{TFSI}]$ containing 50 vol% of PVDF; b. a. VT ^1H and ^{19}F spectra of $[\text{C}_2\text{mpyr}][\text{FSI}]$ and $[\text{C}_2\text{mpyr}][\text{FSI}]$ containing 50 vol% of PVDF ; c. a. VT ^1H and ^{19}F spectra of $[\text{C}_2\text{mpyr}][\text{BF}_4]$ and $[\text{C}_2\text{mpyr}][\text{BF}_4]$ containing 50 vol% of PVDF

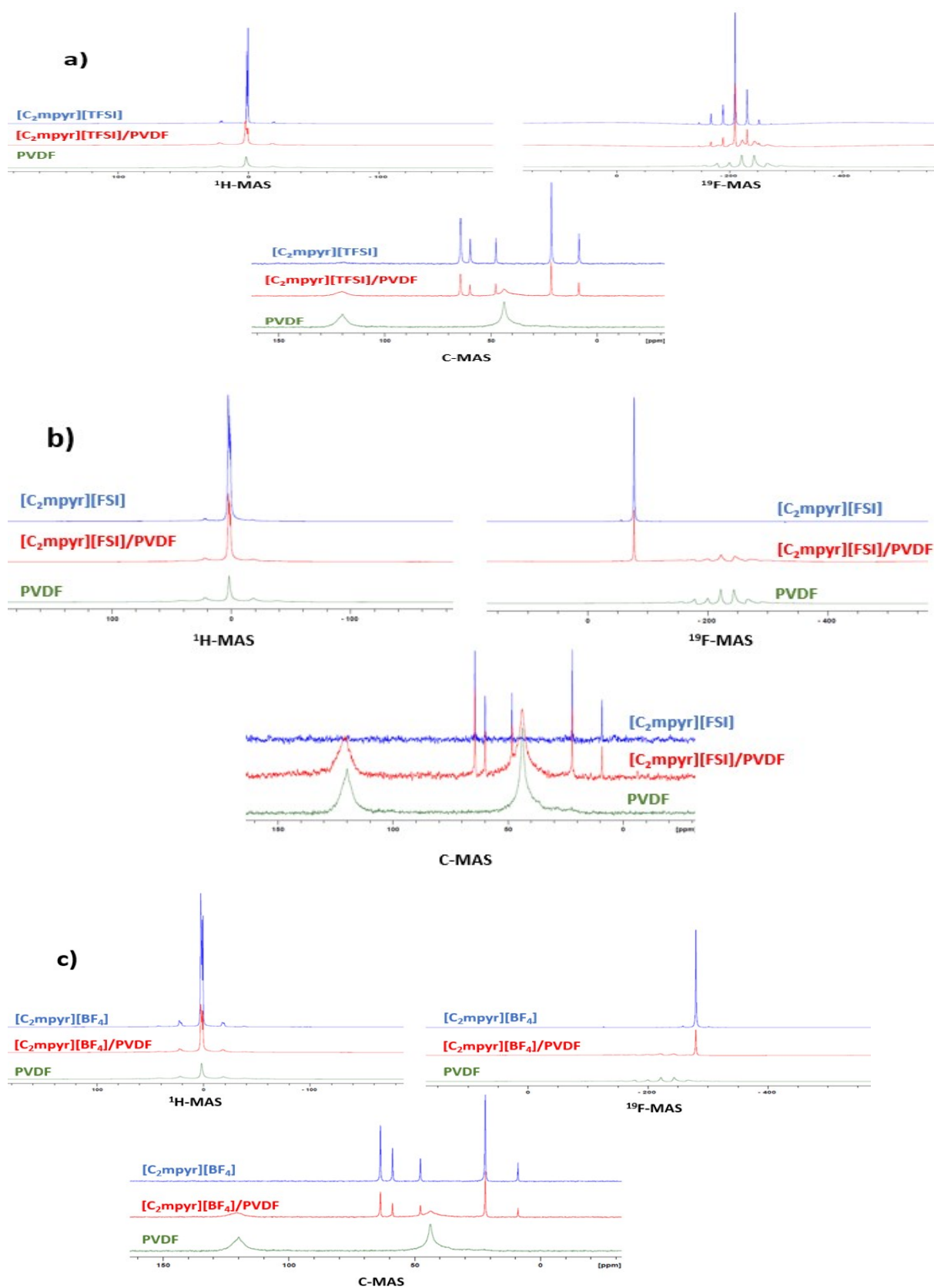


Figure S4; Comparison of the ^1H , ^{19}F and ^{13}C -MAS of the OIPC, OIPC/PVDF composites and PVDF; a) $[\text{C}_2\text{mpyr}][\text{TFSI}]$, $[\text{C}_2\text{mpyr}][\text{TFSI}]/\text{PVDF}$ and PVDF; b) $[\text{C}_2\text{mpyr}][\text{FSI}]$, $[\text{C}_2\text{mpyr}][\text{FSI}]/\text{PVDF}$ and PVDF; c) $[\text{C}_2\text{mpyr}][\text{BF}_4]$, $[\text{C}_2\text{mpyr}][\text{BF}_4]/\text{PVDF}$ and PVDF

References

- 1 M. Forsyth, T. Chimdi, A. Seeber, D. Gunzelmann and P. C. Howlett, *Journal of Materials Chemistry A*, 2014, **2**, 3993–4003.
- 2 W. A. Henderson, V. G. Young, S. Passerini, P. C. Trulove and H. C. De Long, *Chemistry of Materials*, 2006, **18**, 934–938.
- 3 Y. Zhou, X. Wang, H. Zhu, M. Armand, M. Forsyth, G. W. Greene, J. M. Pringle and P. C. Howlett, *Physical Chemistry Chemical Physics*, 2017, **19**, 2225–2234.
- 4 N. Iranipour, D. J. Gunzelmann, A. Seeber, J. Vongsvivut, C. Doherty, F. Ponzio, L. A. O'dell, A. F. Hollenkamp, M. Forsyth and P. C. Howlett, *Journal of Materials Chemistry A*, 2015, **3**, 6038–6052.