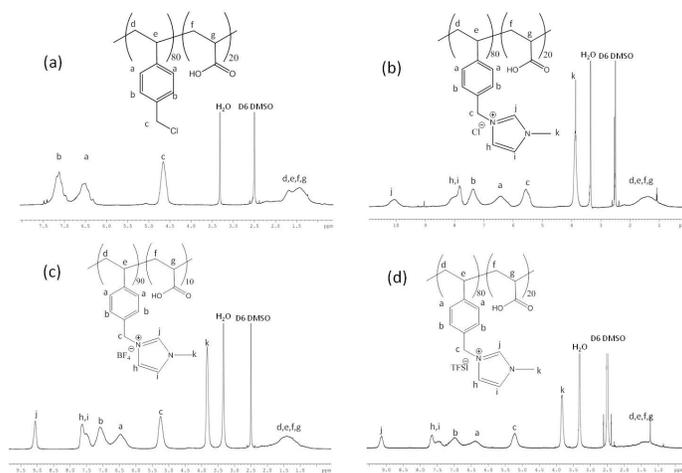


## Supplementary Materials: Synthesis of imidazolium based PILs and investigation of their blend membranes for gas separation

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**Figure 1.** <sup>1</sup>H NMR spectra of (a) precursor copolymer P(VBC-co-AA), (b) P(VBCImCl-co-AA<sub>20</sub>) based PIL containing Cl anion, (c) P(VBCImBF<sub>4</sub>-co-AA<sub>10</sub>) based PIL containing BF<sub>4</sub> anion and (d) P(VBCImTFSI-co-AA<sub>20</sub>) based PIL containing TFSI anion.

<sup>1</sup>H NMR spectroscopy measurements were also employed in order to confirm anion exchange in the synthesized PILs (Figure S1). It is evident that for PILs containing either BF<sub>4</sub> or TFSI anions, peaks assigned to protons of imidazolium ring as well as aromatic protons of VBC backbone are shifted upfield when compared to PIL containing chloride anions. For example, the slightly acidic proton at C2 position in imidazolium ring is more shielded and shifted from 10.16 ppm (j in Figure S1) to 9.1 ppm when the anion was exchanged from chloride to BF<sub>4</sub> or TFSI, as a result of the stronger interaction e.g. hydrogen bonding between the chloride anion and C-2 position proton. These findings together with <sup>19</sup>F NMR data (Figure S2) support that successful anion exchange reactions took place.

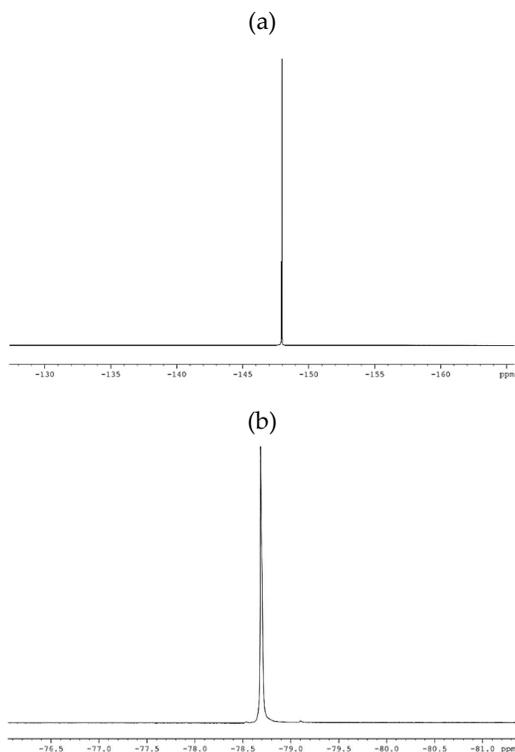


Figure 2. <sup>19</sup>F NMR spectra of (a) P(VBCImBF<sub>4</sub>-co-AA<sub>10</sub>) and (b) P(VBCImTFSI-co-AA<sub>20</sub>).

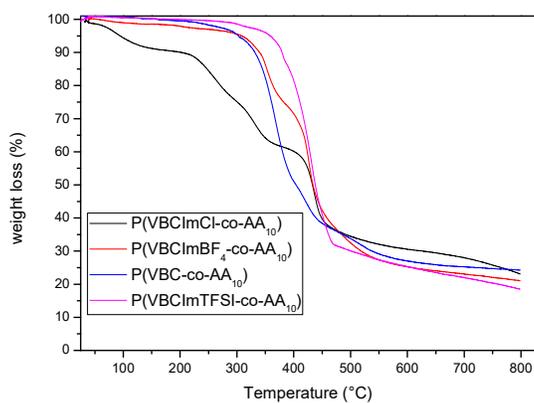


Figure 3. TGA curves of precursor P(VBC-co-AA<sub>10</sub>) and its PILs analogues containing different counter anions.

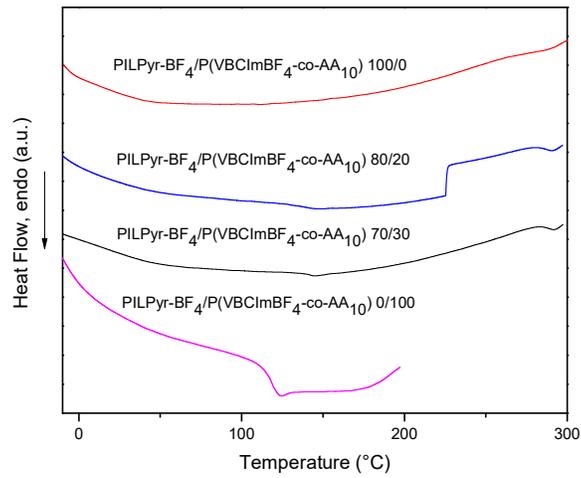


Figure 4. DSC thermograms of PILPyr-BF<sub>4</sub>/P(VBCImBF<sub>4</sub>-co-AA<sub>10</sub>) blends.

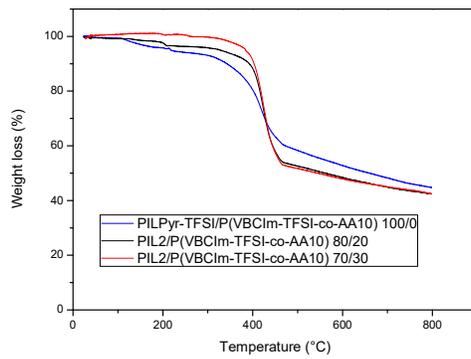


Figure 5. TGA curves of PILPyr-TFSI/P(VBCImTFSI-co-AA<sub>10</sub>) blends.

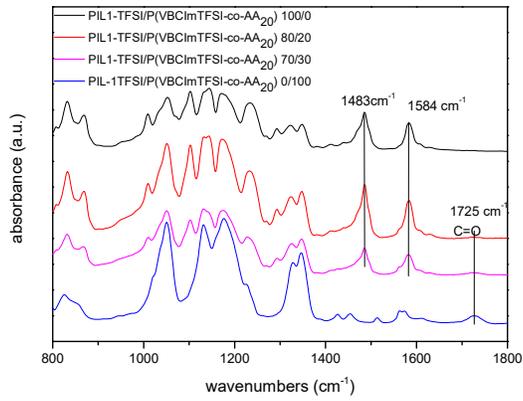


Figure 6. ATR-FT-IR spectra of PILPyr-TFSI/P(VBCImTFSI-co-AA<sub>20</sub>) blends.



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