

NMR investigations on protic ionic liquids for electrolytes applications

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Developing safer electrolytes is urgently required to improve the performance of energy storage devices. To this end, ionic liquids have been extensively investigated as electrolyte components. A drawback of using conventional aprotic ionic liquids (AILs) in this technology is their complex synthesis which hampers their mass products. As an alternative, protic ionic liquids (PILs) emerge as potential electrolyte components because they have all the characteristics of conventional AILs and the advantage to be synthesized by a one-step neutralization reaction of Brønsted acid and Brønsted base. Thus, the present work studied a set of PILs based on the 1,8-diazabicyclo-[5,4,0]-undec-7-ene (DBUH⁺) cation and anions obtained from very strong acids, such as trifluoromethanesulfonate (TFO⁻), (trifluoromethanesulfonyl-nonafluorobutylsulfonyl)imide (IM14⁻), and bis(trifluoromethanesulfonyl)imide (TFSI⁻) (Figure 1). Nuclear magnetic resonance (NMR) spectroscopy was employed to probe the structure and dynamics of these. In particular, 1D ¹H- and ¹⁵N-NMR were employed to probe the protonation status of the DBU base. Additionally, Pulsed Field Gradient (PFG)-NMR was performed to evaluate ions' mobilities into the bulk liquid. The NMR findings can give new insights about dynamics and charge transport PILs suggesting new strategies to develop safer electrolytes for energy storage devices.

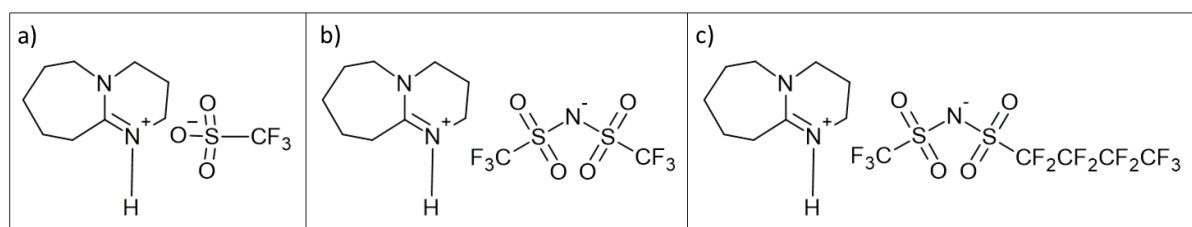


Figure 1. Structure of the PILs studied DBUH-TFO (a), DBUH-TFSI (b), DBUH-IM14 (c).