Electronic Supplementary Information (ESI)

Binary Mixtures of Proton-conducting Ionic Liquids as Electrolytes for Medium-Temperature Polymer Electrolyte Membrane Fuel Cells

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Supplementary Figure S1 shows the FT–IR spectra of the PILs mixtures at room temperature.

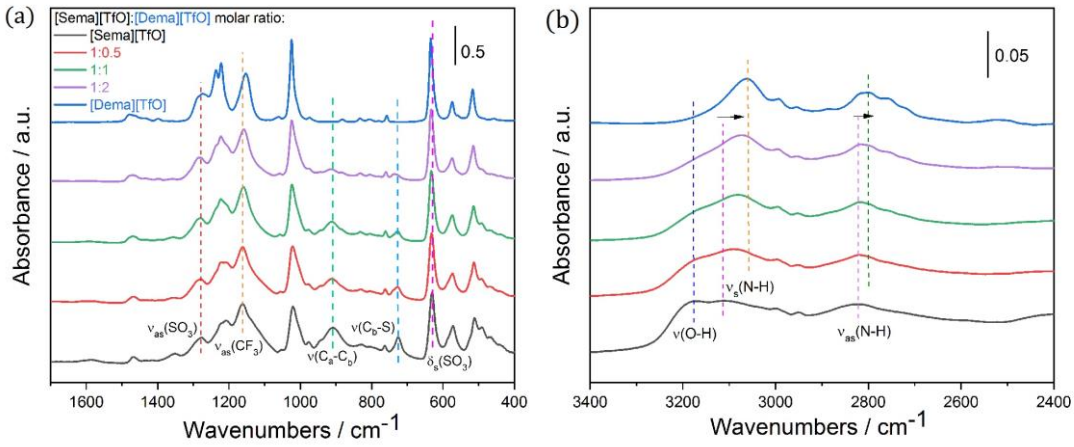

Fig. S1. FT–IR spectra of the PIL mixtures with different molar ratios at room temperature. From the bottom to the top are shown: neat [2-Sema][TfO], [2-Sema][TfO]:[Dema][TfO]=1:0.5, 1:1, 1:2 and neat [Dema][TfO].

In the case of neat [2-Sema][TfO], the prominent bands are observed in the range of 1400–400 cm^{-1}, which are shown in Fig. S1a. The peaks at 1276, 1021, 631, and 512 cm^{-1} are assigned to the asymmetrical stretching $\nu_{as}(SO_3)$, symmetrical stretching $\nu_s(SO_3)$, symmetrical deformation $\delta_s(SO_3)$, and asymmetrical deformation $\delta_{as}(SO_3)$, respectively. The peaks located at 1210, 1162, and 572 cm^{-1} are contributed to the symmetrical stretching $\nu_s(CF_3)$, asymmetrical stretching $\nu_{as}(CF_3)$, and asymmetrical deformation $\delta_{as}(CF_3)$ of the triflate anion, respectively.[1] The $\nu(C_a\text{-}C_b)$ vibration and $\nu(C_b\text{-}S)$ vibration mode of $CH_3NH_2^+(C_aH_2C_bH_2)SO_3H$ of $[2\text{-Sema}]^+$ were observed at 907 cm^{-1} and 725 cm^{-1}.[2] As expected, the $\nu(C_a\text{-}C_b)$ and $\nu(C_b\text{-}S)$ decreased in

intensity with increasing fractions of [Dema][TfO] (see Fig. S1a). As is indicated in Fig. S1b, the spectral region of the O-H, N-H, and C-H stretching vibration is located in the range of 3300–2700 cm^{-1}. The peak centered at 3174 cm^{-1} is attributed to the O–H bonding of neat [2-Sema][TfO]. The symmetrical and asymmetrical stretching of the N–H bonding of neat [Dema][TfO] is observed at 3113 cm^{-1} and 2822 cm^{-1}, respectively.[3] An overlay of the peaks of the neat PILs is shown with an increase in the [Dema][TfO] in the mixture, which confirms the varying molar fractions of the cations in the PIL blends.

Supplementary Figure S2 shows the viscosity of PIL blends at different temperatures.

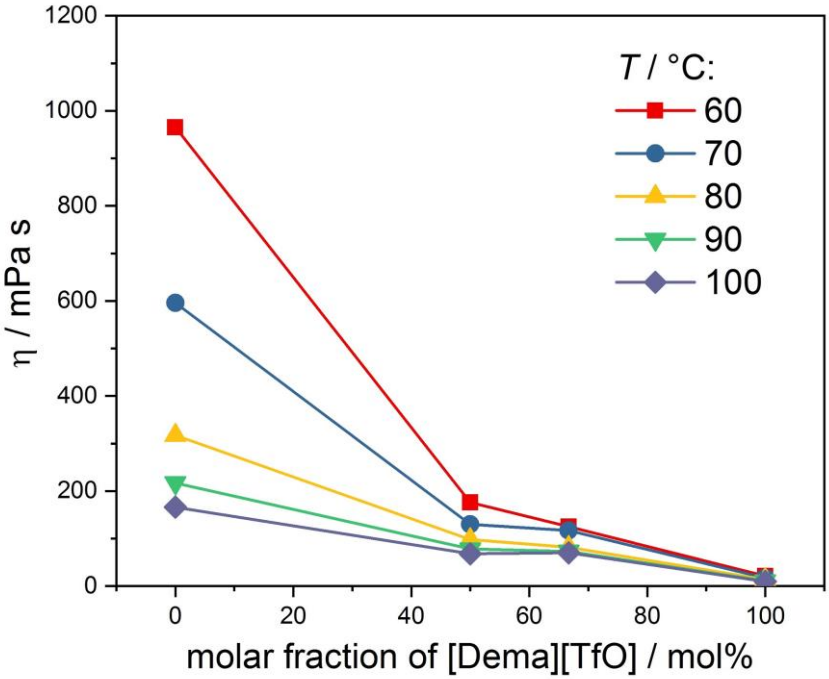

Fig. S2. The viscosity of neat PILs and PIL blends at temperatures of 60–100 °C.

References:

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