Electronic Supplementary Information

Phase Equilibrium and Physical Properties of Biobased Ionic Liquid Mixtures

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1. Proton Nuclear Magnetic Resonance (^{1}H NMR)

The spectrums for all PILs obtained by ^{1}H NMR are presented below:

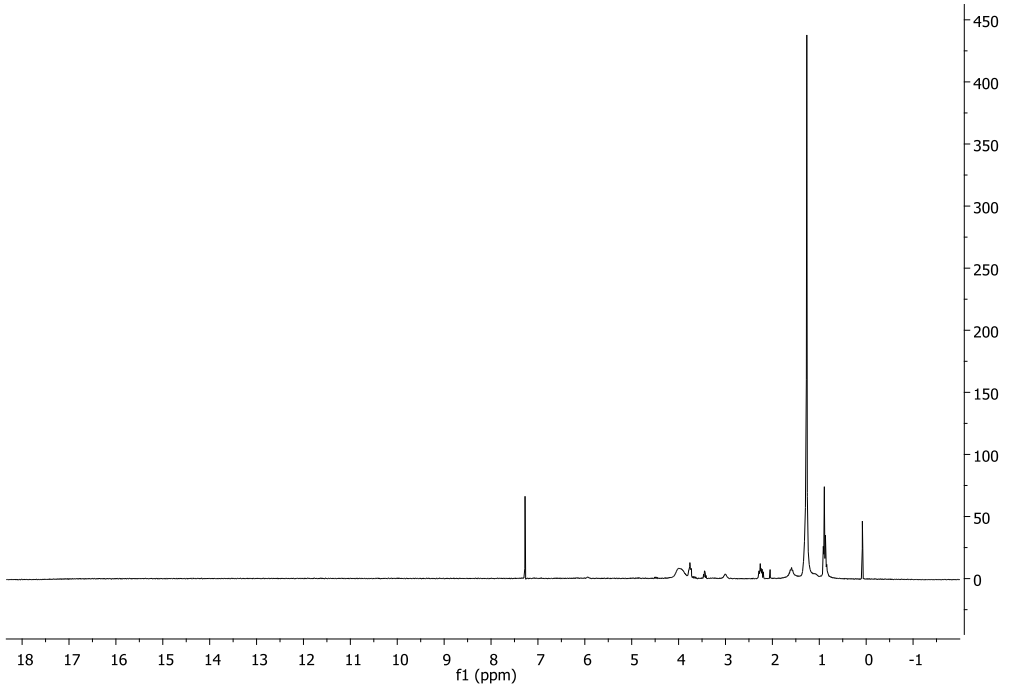

Figure 1. ^{1}H NMR spectrum for 2-hydroxy ethylammonium tetradecanoate [HEA][C_{14}OO].

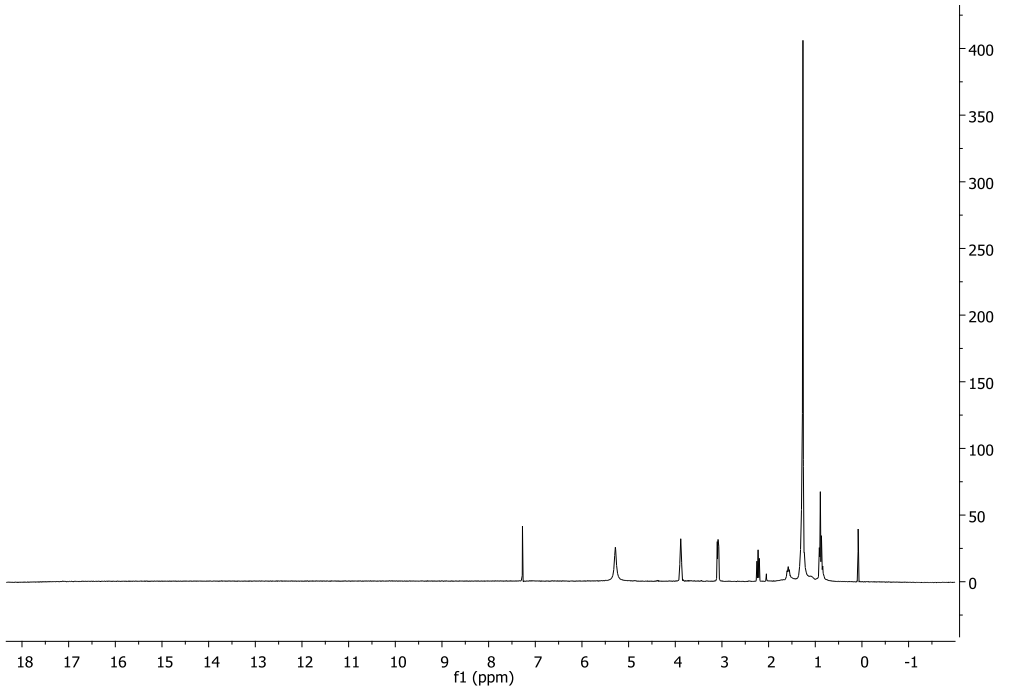

Figure 2. ^{1}H NMR spectrum for bis(2-hydroxy ethyl)ammonium tetradecanoate [H_2EA][C_{14}OO].

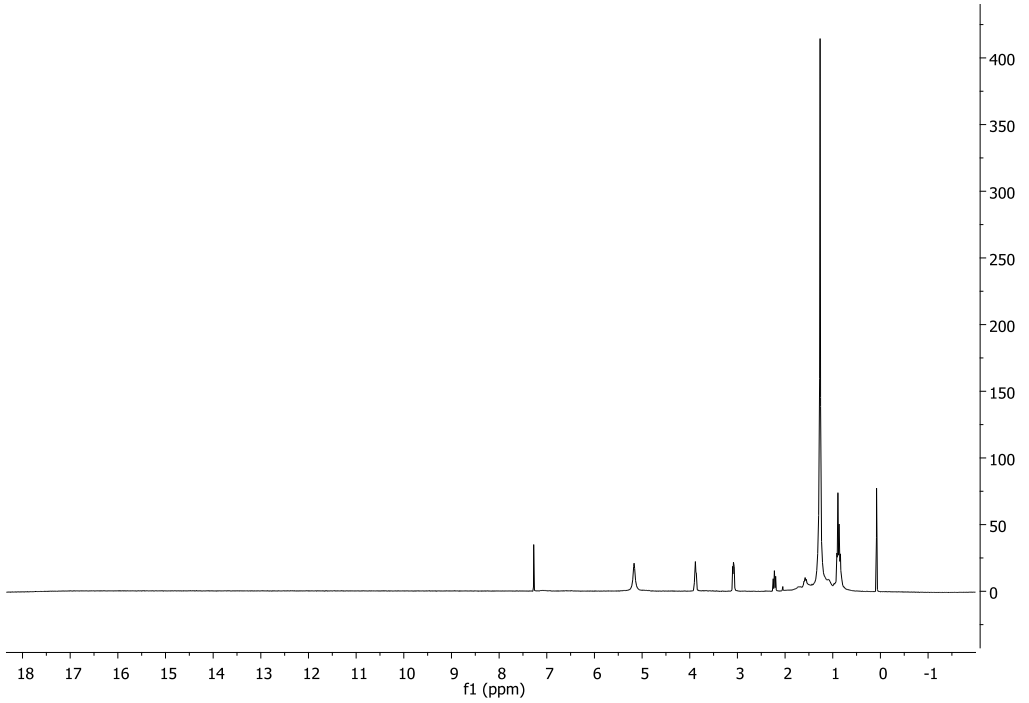

Figure 3. ^{1}H NMR spectrum for bis(2-hydroxy ethyl)ammonium hexadecanoate $[H_2EA][C_{16}OO]$.

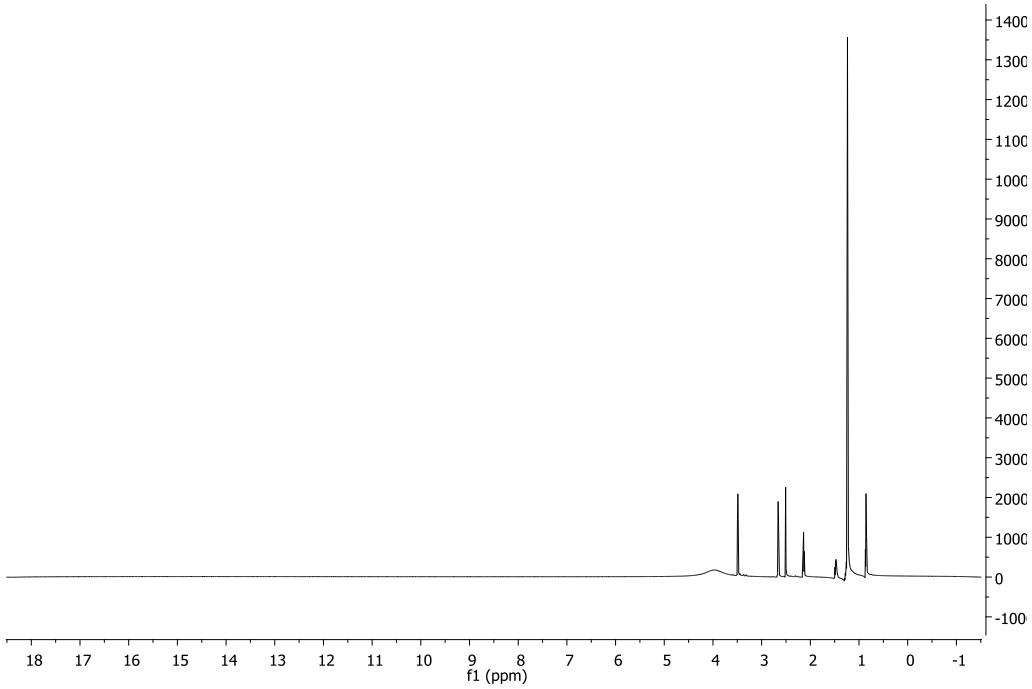

Figure 4. ^{1}H NMR spectrum for bis(2-hydroxy ethyl)ammonium octadecanoate $[H_2EA][C_{18}OO]$.

2. Attenuated Total Reflectance-Fourier Transform Infrared spectroscopy (ATR-FTIR)

The spectrums for all PILs obtained by ATR-FTIR are presented below:

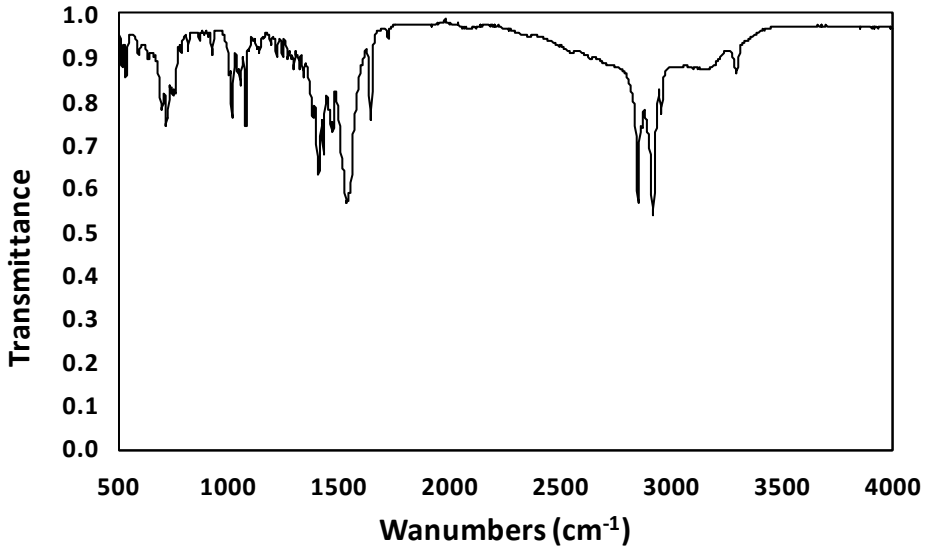

Figure 5. ATR-FTIR spectrum for 2-hydroxy ethylammonium tetradecanoate [HEA][C_{14}OO].

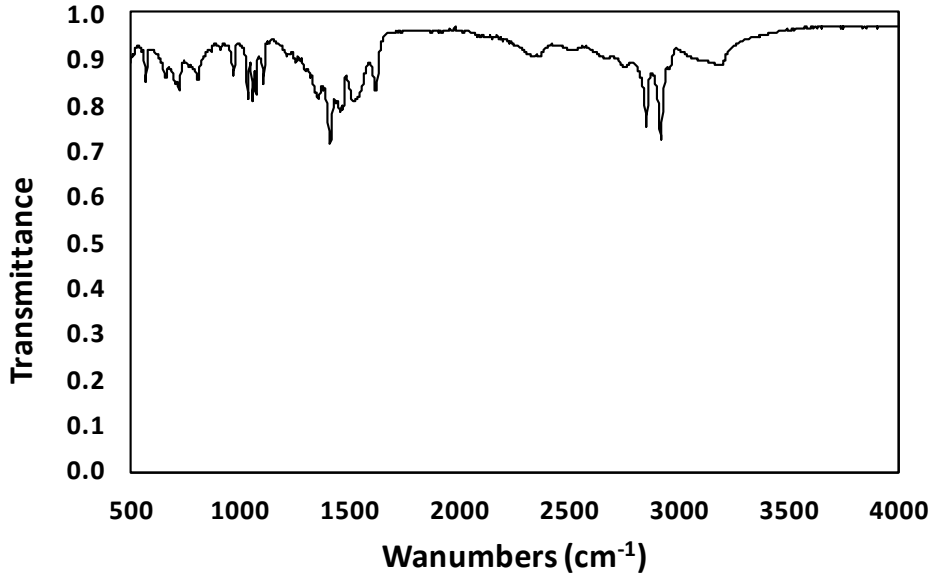

Figure 6. ATR-FTIR spectrum for bis(2-hydroxy ethyl)ammonium tetradecanoate [H_2EA][C_{14}OO].

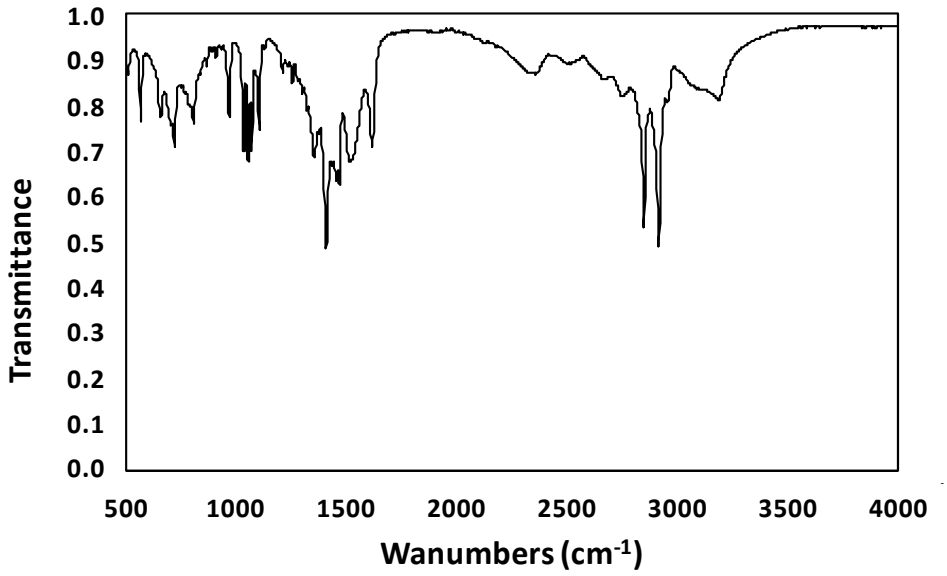

Figure 7. ATR-FTIR spectrum for bis(2-hydroxy ethyl)ammonium hexadecanoate $[H_2EA][C_{16}OO]$.

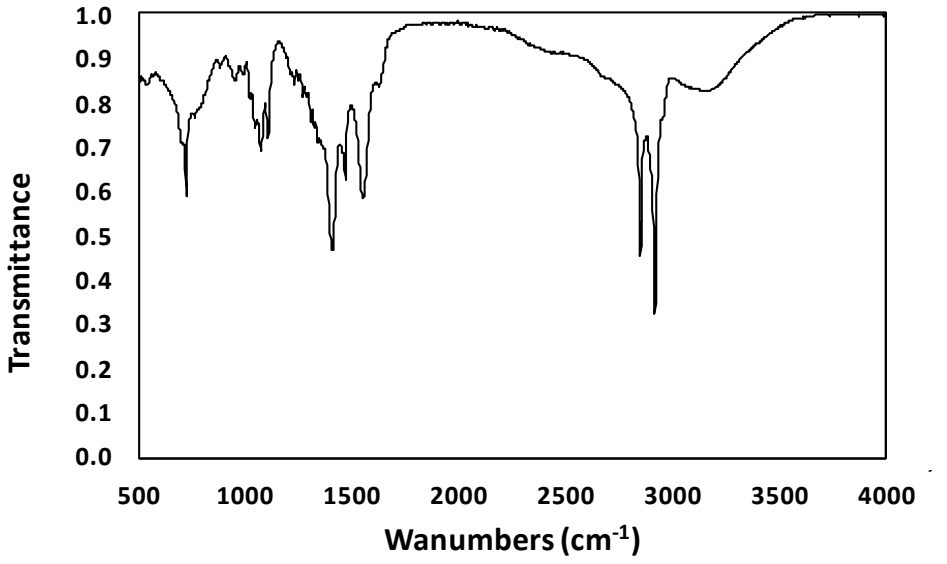

Figure 8. ATR-FTIR spectrum for bis(2-hydroxy ethyl)ammonium octadecanoate $[H_2EA][C_{18}OO]$.

3. Rheological profiles

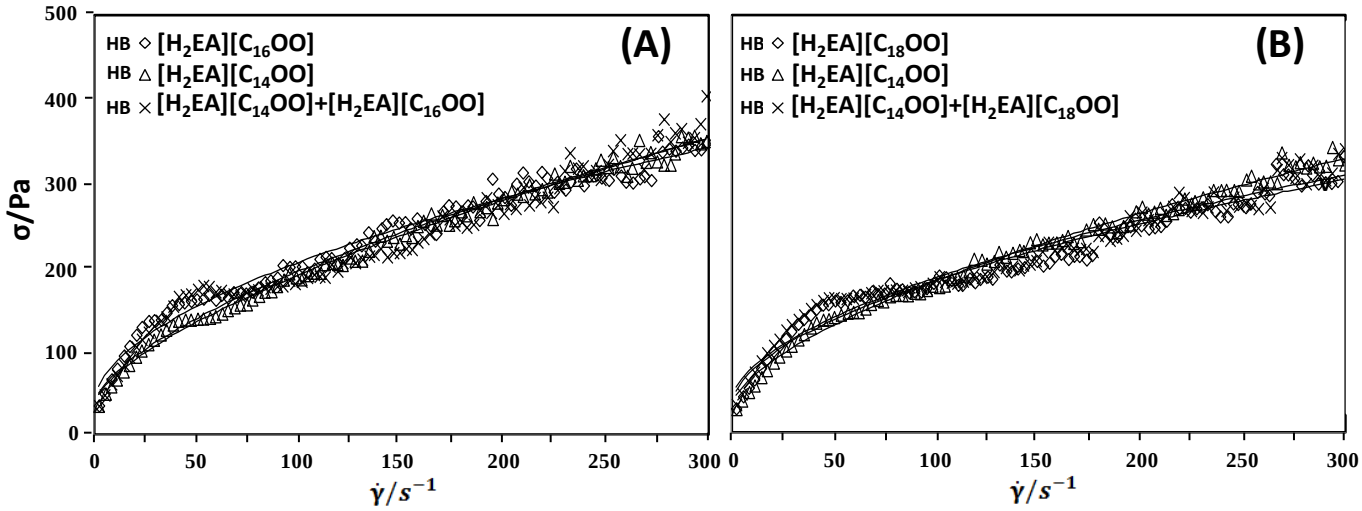

Figure 9. Shear stress (σ) versus shear rate ($\dot{\gamma}$) curves of pure protic ionic liquids (PILs) and their binary mixtures at $x_1 = 0.5$: (A) $[H_2EA][C_{14}OO]$ + $[HEA][C_{16}OO]$ at 338.15 K, (B) $[H_2EA][C_{14}OO]$ + $[HEA][C_{18}OO]$ at 343,15 K at 338.15 K. Solid lines are the fitted curves for Herschel-Bulkley model, represented by **HB** label.

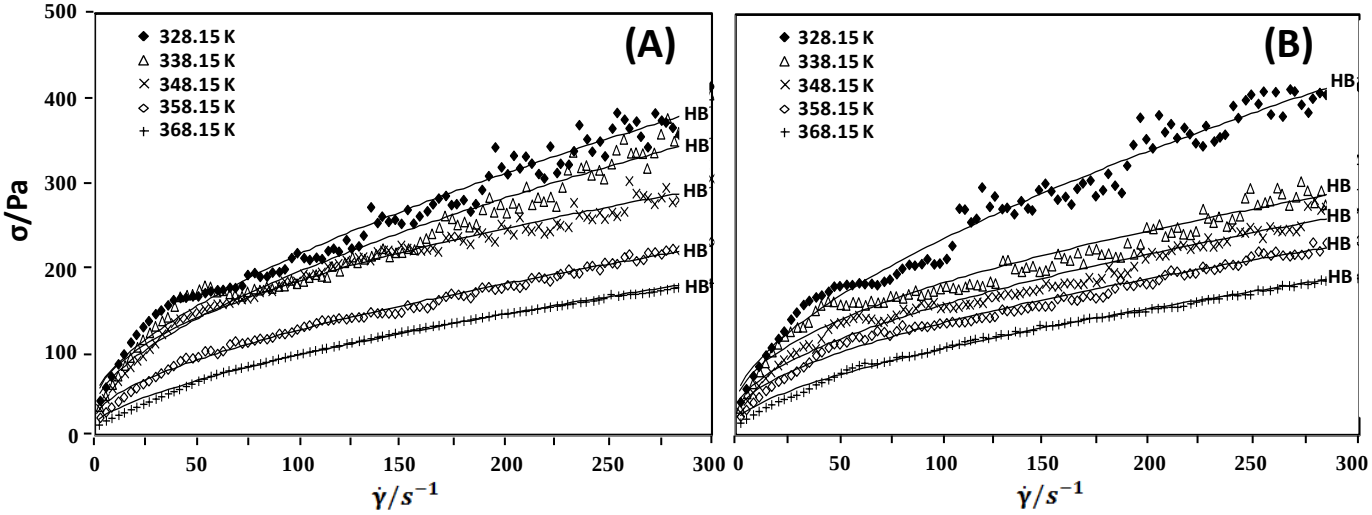

Figure 10. Shear stress (σ) versus shear rate ($\dot{\gamma}$) curves of protic ionic liquids (PILs) binary mixtures ($x_1 = 0.5$) at different temperatures 328.15-368.15 K: (A) $[H_2EA][C_{14}OO]$ + $[HEA][C_{16}OO]$, (B) $[H_2EA][C_{14}OO]$ + $[HEA][C_{18}OO]$. Solid lines are the fitted curves for Herschel-Bulkley model, represented by **HB** label.

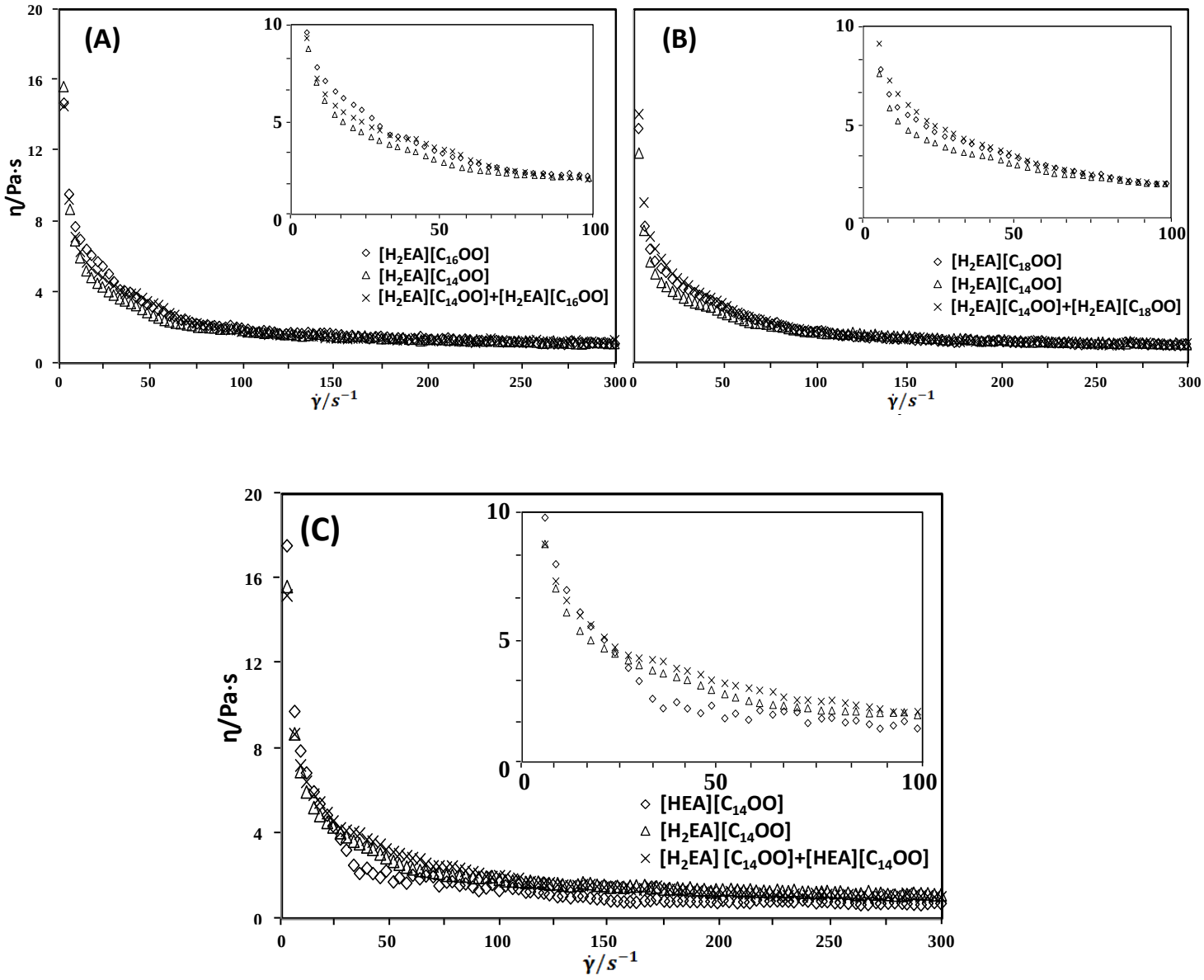

Figure 11. Apparent viscosity data of protic ionic liquids (PILs) and their binary mixtures at $x_1 = 0.5$: (A) $[H_2EA][C_{14}OO]$ + $[HEA][C_{16}OO]$ at 338.15 K, (B) $[H_2EA][C_{14}OO]$ + $[HEA][C_{18}OO]$ at 343,15 K, (C) $[H_2EA][C_{14}OO]$ + $[HEA][C_{14}OO]$ at 338.15 K.

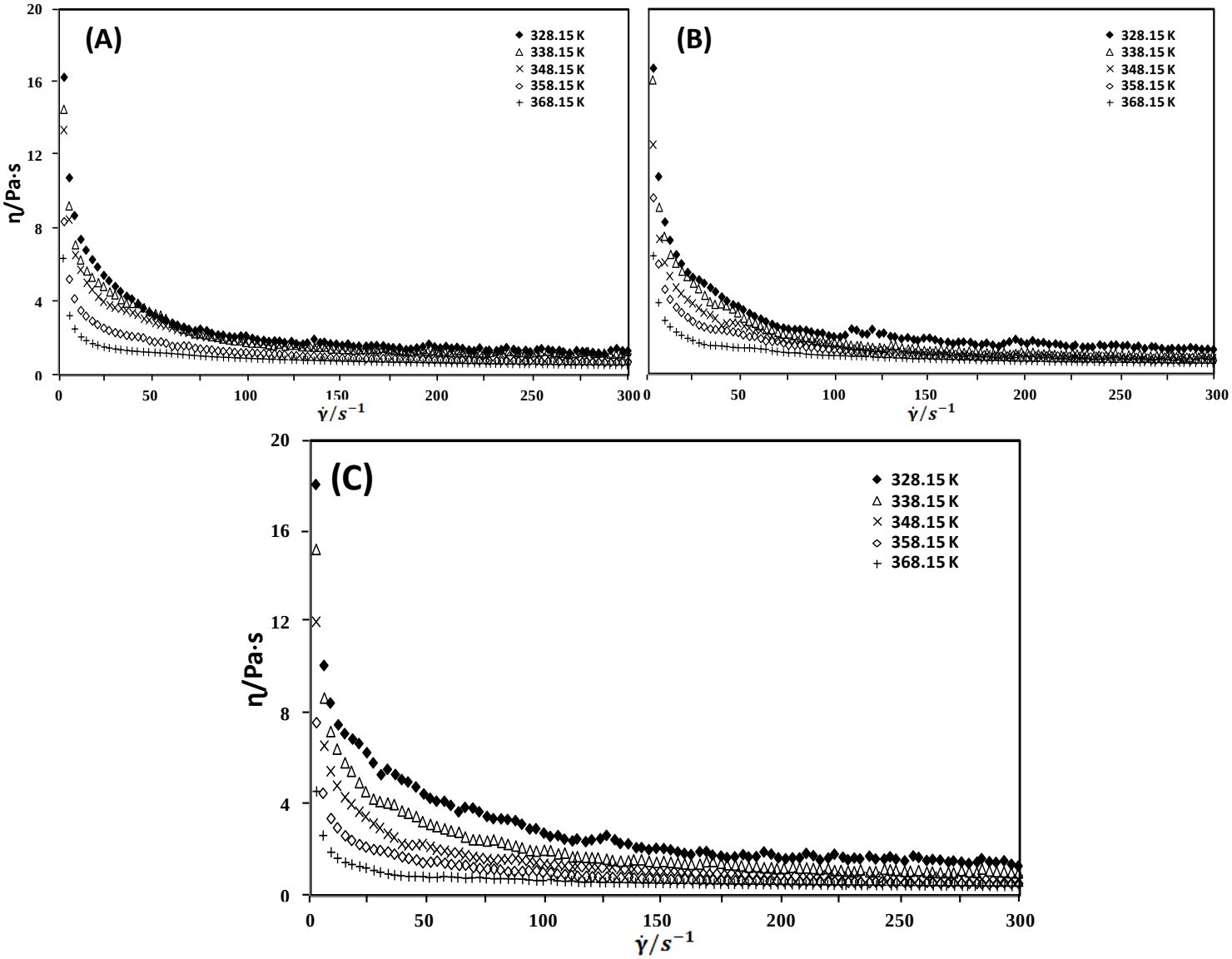

Figure 12. Apparent viscosity data of protic ionic liquids (PILs) binary mixtures ($x_1 = 0.5$) at different temperatures 328.15-368.15 K: (A) $[H_2EA][C_{14}OO]$ + $[HEA][C_{16}OO]$ (B) $[H_2EA][C_{14}OO]$ + $[HEA][C_{18}OO]$ (C) $[H_2EA][C_{14}OO]$ + $[HEA][C_{14}OO]$.