**Figure 1 (a).** Distribution coefficients ($K$) of the alcohol mol fraction in both phases as a function of temperature for [C$_2$ mim][Tf$_2$N] with butan-1-ol: (◊) experimental [14], (■) COSMO-RS prediction calculations with the lowest energy conformers, (▲) COSMO-RS prediction calculations with the higher energy conformers.
Figure 2 (a). Distribution coefficients ($K$) of the alcohol mol fraction in both phases as a function of temperature for [C$_4$mim][BF$_4$] (Δ) and [C$_4$mim][PF$_6$] (◊) with butan-1-ol. The empty and full symbols represent respectively the experimental data [6,21] and the COSMO-RS prediction calculations.
Figure 2 (b). Liquid-liquid phase diagram for [C₆mim][BF₄] (Δ) (-----) and [C₆mim][Tf₂N] (◊) (———) with hexan-1-ol. The single symbols and the lines represent respectively the experimental data [6] and the COSMO-RS prediction calculations.
Figure 2 (c). Liquid-liquid phase diagram for [C₆mim][BF₄] (Δ) (-----), [C₆mim][Tf₂N] (◊) (-----), [C₈mim][BF₄] (×) (-----) and [C₈mim][Tf₂N] (□) (-----) with octan-1-ol. The single symbols and the lines represent respectively the experimental data [6,7] and the COSMO-RS prediction calculations.
Figure 2 (d). Liquid-liquid phase diagram $[\text{C}_4\text{mpy}][\text{BF}_4]$ ($\triangle$) (---) and $[\text{C}_4\text{mpy}][\text{TF}_2\text{N}]$ ($\bigcirc$) (-----) with butan-1-ol. The single symbols and the lines represent respectively the experimental data [8] and the COSMO-RS prediction calculations.
**Figure 3 (a).** Distribution coefficients ($K$) of the alcohol mol fraction in both phases as a function of temperature for [C$_4$mim][BF$_4$] (□) and [C$_4$mpy][BF$_4$] (○) with propan-1-ol, and [C$_4$mim][BF$_4$] (◊) and [C$_4$mpy][BF$_4$] (Δ) with butan-1-ol. The empty and full symbols represent respectively the experimental data [6,8] and the COSMO-RS prediction calculations.
Figure 3 (b). Liquid-liquid phase diagram for \([\text{C}_6\text{mim}]\text{[Tf}_2\text{N}]\) (\(\Delta\)) (---) and \([\text{C}_6\text{mpy}]\text{[Tf}_2\text{N}]\) (\(\times\)) (----) with hexan-1-ol. The single symbols and the lines represent respectively the experimental data [6,7] and the COSMO-RS prediction calculations.
Figure 6 (a). Distribution coefficients ($K$) of the alcohol mol fraction in both phases as a function of temperature for [C$_6$py][Tf$_2$N] (□) and [C$_6$mpy][Tf$_2$N] (Δ) with hexan-1-ol. The empty and full symbols represent respectively the experimental data [8] and the COSMO-RS prediction calculations.
Figure 7 (a). Distribution coefficients ($K$) of the alcohol mol fraction in both phases as a function of temperature for [C$_4$mim][BF$_4$] (◊) and [C$_6$mim][BF$_4$] (Δ) with butan-1-ol. The single symbols and the lines represent respectively the experimental data [8] and the COSMO-RS prediction calculations.
Figure 7 (b). Liquid-liquid phase diagram for [C₄mim][BF₄] (□) (---), [C₆mim][BF₄] (◊) (----) and [C₈mim][BF₄] (Δ) (-------) with hexan-1-ol. The single symbols and the lines represent respectively the experimental data [6,7] and the COSMO-RS prediction calculations.
**Figure 7 (c).** Liquid-liquid phase diagram for \([\text{C}_6\text{mim}][\text{BF}_4]\) (□) (\(--\)) and \([\text{C}_8\text{mim}][\text{BF}_4]\) (◊) (\(\cdots\)) with octan-1-ol. The single symbols and the lines represent respectively the experimental data [6,7] and the COSMO-RS prediction calculations.
Figure 7 (d). Liquid-liquid phase diagram for [C$_2$ mim][Tf$_2$N] (□) and [C$_4$ mim][Tf$_2$N] (◊) with butan-1-ol. The single symbols and the lines represent respectively the experimental data [6,14] and the COSMO-RS prediction calculations.
Figure 7 (e). Liquid-liquid phase diagram for [C₆mim][Tf₂N] (Δ) (-------) and [C₈mim][Tf₂N] (◊) (-----) with octan-1-ol. The single symbols and the solid lines represent respectively the experimental data [7] and the prediction by the COSMO-RS calculation.
**Figure 10 (a).** Distribution coefficients ($K$) of the alcohol mol fraction in both phases as a function of temperature for [C₄mim][BF₄] with propan-1-ol (◊), butan-1-ol (Δ) and hexan-1-ol (□). The single symbols and the lines represent respectively the experimental data [6] and the COSMO-RS prediction calculations.
Figure 10 (b). Liquid-liquid phase diagram for [C₆mim][BF₄] with butan-1-ol (◊) and hexan-1-ol (□) and octan-1-ol (Δ). The single symbols and the solid lines represent respectively the experimental data [6] and the prediction by the COSMO-RS calculation.
Figure 10 (c). Liquid-liquid phase diagram for [C₈mim][BF₄] with pentan-1-ol (□) (-----), hexan-1-ol (◊) (------) and octan-1-ol (Δ) (--------). The single symbols and the solid lines represent respectively the experimental data [7,13] and the prediction by the COSMO-RS calculation.
Figure 10 (d). Liquid-liquid phase diagram for [C₄mim][PF₆] with ethanol (◊), propan-1-ol (□) and butan-1-ol (Δ). The single symbols and the solid lines represent respectively the experimental data [22] and the prediction by the COSMO-RS calculation.
Figure 10 (e). Liquid-liquid phase diagram for [C$_2$ mim][Tf$_2$ N] with propan-1-ol ($\times$) (---), butan-1-ol ($\Delta$) (-----) and pentan-1-ol (□) (---------------). The single symbols and the solid lines represent respectively the experimental data [15] and the prediction by the COSMO-RS calculation.
Figure 10 (f). Liquid-liquid phase diagram for [C₄mim][Tf₂N] with butan-1-ol (∙) and hexan-1-ol (□). The single symbols and the solid lines represent respectively the experimental data [6] and the prediction by the COSMO-RS calculation.
Figure 10 (g). Liquid-liquid phase diagram for [C₆mim][Tf₂N] with butan-1-ol (Δ) (dashdot), pentan-1-ol (×) (dash), hexan-1-ol (□) (dashed line) and octan-1-ol (◊) (solid line). The single symbols and the solid lines represent respectively the experimental data [7,12] and the prediction by the COSMO-RS calculation.
Figure 10 (h). Liquid-liquid phase diagram for [C$_3$C$_1$mim][Tf$_2$N] with butan-1-ol (◊) (---) and hexan-1-ol (□) (---------------). The single symbols and the solid lines represent respectively the experimental data [6] and the prediction by the COSMO-RS calculation.
Figure 10 (i). Liquid-liquid phase diagram for [C4mpy][BF₄] with propan-1-ol (×) (———) and butan-1-ol (◊) (———). The single symbols and the solid lines represent respectively the experimental data [8] and the prediction by the COSMO-RS calculation.
Figure 10 (j). Liquid-liquid phase diagram for [C\text{ampy}][\text{Tf}_2\text{N}] with butan-1-ol (Δ) (- - - - - -) and hexan-1-ol (□) (-----). The single symbols and the solid lines represent respectively the experimental data [8] and the prediction by the COSMO-RS calculation.
Figure 11 (a). Liquid-liquid phase diagram for [C₄mim][Tf₂N] with butan-1-ol (×) (— — —), and isobutanol (◊) (—— ———). The single symbols and the solid lines represent respectively the experimental data [6,9] and the prediction by the COSMO-RS calculation.
Figure 13 (a). Vapour-liquid phase diagram at 298.15 K $[\text{[C}_4\text{mim}]\text{[Tf}_2\text{N}]$ (Δ) (-----) and $[\text{[C}_4\text{mim}]\text{[OctS]}$ (◊) (-----) with methanol. The single symbols and the lines represent respectively the experimental data [26,31] and the COSMO-RS prediction calculations.
Figure 13 (b). Vapour-liquid phase diagram at 298.15 K $[\text{C}_4\text{mim}][\text{Tf}_2\text{N}]$ (Δ) (---) and $[\text{C}_4\text{mim}][\text{OctS}]$ (◊) (-----) with ethanol. The single symbols and the lines represent respectively the experimental data [26,31] and the COSMO-RS prediction calculations.
Figure 13 (c). Vapour-liquid phase diagram at 313.15 K for \([\text{C}_{4}\text{mim}]\text{[Tf}_2\text{N}]\) (Δ) (-----) and \([\text{C}_{4}\text{mim}]\text{[OctS]}\) (◊) (——) with methanol. The single symbols and the lines represent respectively the experimental data [26,31] and the COSMO-RS prediction calculations.
**Figure 13 (d).** Vapour-liquid phase diagram at 313.15 K for $[C_4\text{mim}][\text{Tf}_2\text{N}]$ (Δ) (-----) and $[C_4\text{mim}][\text{OctS}]$ (◊) (——) with ethanol. The single symbols and the lines represent respectively the experimental data [26,31] and the COSMO-RS prediction calculations.
Figure 13 (e). Vapour-liquid phase diagram at 313.15 K for [C₄mim][Tf₂N] (Δ) (-----) and [C₄mim][OctS] (◊) (-----) with propan-1-ol. The single symbols and the lines represent respectively the experimental data [26,31] and the COSMO-RS prediction calculations.
Figure 16 (a). Vapour-liquid phase diagram at 303.15 K for [C₄mim][Tf₂N] with methanol (◊), ethanol (□) and propan-1-ol (△). The single symbols and the lines represent respectively the experimental data [31] and the COSMO-RS prediction calculations.
Figure 16 (b). Vapour-liquid phase diagram at 313.15 K for [C₄mim][Tf₂N] with methanol (◊), ethanol (□) and propan-1-ol (Δ). The single symbols and the lines represent respectively the experimental data [31] and the COSMO-RS prediction calculations.
Figure 16 (c). Vapour-liquid phase diagram at 353.15 K for [C<sub>1</sub>mim][CH<sub>3</sub>PO<sub>4</sub>] with methanol (□) (-----) and ethanol (Δ) (--------). The single symbols and the lines represent respectively the experimental data [24] and the COSMO-RS prediction calculations.
Figure 16 (d). Vapour-liquid phase diagram at 298.15 K for [C₄mim][OctS] with methanol (◊), ethanol (□) and propan-1-ol (Δ). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
Figure 16 (e). Vapour-liquid phase diagram at 313.15 K for [C$_4$mim][OctS] with methanol (◊) (----), ethanol (□) (---------------) and propan-1-ol (Δ) (-------). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
Figure 16 (f). Vapour-liquid phase diagram at 298.15 K for [C₈mim][BF₄] with methanol (◊), ethanol (□) and propan-1-ol (Δ). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
Figure 16 (g). Vapour-liquid phase diagram at 313.15 K for [C₈mim][BF₄] with methanol (○) (---), ethanol (□) (——) and propan-1-ol (Δ) (-----). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
**Figure 17 (a).** Vapour-liquid phase diagram for [C\text{4}mim][T\text{f}2\text{N}] and methanol at isotherms: 298.15 K (◊) (---), 303.15 K (Δ) (-- -- -- -- --), 308.15 K (×) (- - - - -) and 313.15 K (□) (---------------). The single symbols and the lines represent respectively the experimental data [31] and the COSMO-RS prediction calculations.
Figure 17 (b). Vapour-liquid phase diagram for [C$_4$mim][Tf$_2$N] and propan-1-ol at isotherms: 298.15 K (◊), 303.15 K (Δ), 308.15 K (×) and 313.15 K (□). The single symbols and the lines represent respectively the experimental data [31] and the COSMO-RS prediction calculations.
Figure 17 (c). Vapour-liquid phase diagram for [C₄mim][OctS] and methanol at isotherms: 298.15 K (◊) (———), 303.15 K (Δ) (·······), 308.15 K (×) (----) and 313.15 K (□) (--·--·--). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
Figure 17 (d). Vapour-liquid phase diagram for \([\text{C}_4\text{mim}]\text{[OctS]}\) and ethanol at isotherms: 298.15 K (◊) (---), 303.15 K (Δ) (-------), 308.15 K (×) (-----) and 313.15 K (□) (---------------). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
Figure 17 (e). Vapour-liquid phase diagram for [C₄mim][OctS] and propan-1-ol at isotherms: 298.15 K (◊) (— — — —), 303.15 K (Δ) (—— — — —), 308.15 K (×) (— — —), and 313.15 K (□) (—— — — —). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
Figure 17 (f). Vapour-liquid phase diagram for [C₈mim][BF₄] and methanol at isotherms: 298.15 K (◊) (---), 303.15 K (Δ) (--------), 308.15 K (×) (-----) and 313.15 K (□) (------------). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
Figure 17 (g). Vapour-liquid phase diagram for [C₈mim][BF₄] and ethanol at isotherms: 298.15 K (◊), 303.15 K (Δ), 308.15 K (×), and 313.15 K (□). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
Figure 17 (h). Vapour-liquid phase diagram for [C₈mim][BF₄] and propan-1-ol at isotherms: 298.15 K (◊) (---), 303.15 K (Δ) (-- ----), 308.15 K (×) (----) and 313.15 K (□) (----------). The single symbols and the lines represent respectively the experimental data [26] and the COSMO-RS prediction calculations.
**Figure 18 (a).** Molar enthalpies of vaporization at 298.15 K of $[C_nH_{2n+1}OH]$ (Δ) (-----) and $[C_n\text{mim}][\text{Tf}_2\text{N}]$ (◊) (---------) as a function of the carbon number (n). The single symbols and the lines represent respectively the experimental data [47-48] and the COSMO-RS prediction calculations.