Supporting information

Isothermal Vapor+Liquid Equilibrium and Thermophysical Properties for 1-Butyl-3-methylimidazolium Bromide + 1-Butanol Binary System

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A. Equations applied which are not shown in the paper:

1. Equations for the mixtures density predictions from mixture refractive indices and refractive indices and densities of the pure components:

- Lorentz-Lorenz mixing rule: $\frac{n_D^2-1}{n_D^2+2}=\phi_1\left(\frac{n_{D,1}^2-1}{n_{D,1}^2+2}\right)+\phi_2\left(\frac{n_{D,2}^2-1}{n_{D,2}^2+2}\right)$ (S1)
- Gladstone-Dale mixing rule: $n_D-1=\phi_1\left(n_{D,1}-1\right)+\phi_2\left(n_{D,2}-1\right)$ (S2)
- Edwards mixing rule: $\frac{n_D-1}{n_D}=\phi_1\frac{n_{D,1}-1}{n_{D,1}}+\phi_2\frac{n_{D,2}-1}{n_{D,2}}$ (S3)
- Eykman mixing rule: $\frac{n_D^2-1}{n_D+0.4}=\phi_1\frac{n_{D,1}^2-1}{n_{D,1}+0.4}+\phi_2\frac{n_{D,2}^2-1}{n_{D,2}+0.4}$ (S4)

with $\phi_i = w_i\rho / \rho_i$ and $w_i = m_i / (m_1 + m_2)$, i = 1, and 2 (components of the binary mixture: [bmim]Br (1) + 1-butanol (2)

2. Equation for surface tension deviation calculation:

$$\sigma^E = \sigma - x\sigma_1 - (1-x)\sigma_2 \quad \text{(S5)}$$

3. Equation for relative permittivity at optical frequency calculation:

$$\varepsilon_r = n_D^2 \quad \text{(S6)}$$

4. Equation for dielectric permittivity calculation:

$$\varepsilon = \varepsilon_r\varepsilon_0 \quad \text{(S7)}$$

where ε_0 is vacuum permittivity $\varepsilon_0 = 8.8541878176.. \times 10^{-12}$ F/m

5. Equation for dielectric permittivity deviation calculation:

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$$\varepsilon^E = \varepsilon - x\varepsilon_1 - (1-x)\varepsilon_2 \quad \text{(S8)}$$

B. Tables which are not shown in the paper:

Table S1. Vapor+liquid equilibrium data for the [bmim]Br (1) + 1-butanol (2) system. Pressure, P_e, temperature, T, and [bmim]Br liquid phase composition, x_e, are experimental data and [bmim]Br vapor phase composition, y_c, activity coefficients, γ_1, γ_2, and excess Gibbs energy, G^E, are calculated data with Wilson model assuming real behavior of the vapor phase

x_e [a]	y_c [a]	P_e [b] / kPa	γ_1	γ_2	G^E / (J mol^{-1})
T [c] = 353.15 K					
0	0	21.24	30.38	1	0
0.064	0.025	20.99	11.97	1.03	539
0.140	0.031	20.61	6.57	1.10	1010
0.215	0.033	20.61	4.48	1.19	1351
0.316	0.034	20.32	3.12	1.36	1666
T [c] = 363.15 K					
0	0	33.85	16.56	1	0
0.063	0.022	33.03	9.35	1.02	478
0.140	0.032	32.11	5.86	1.07	930
0.219	0.036	31.66	4.17	1.15	1281
0.321	0.038	31.03	3.00	1.30	1605
T [c] = 373.15 K					
0	0	51.69	15.04	1	0
0.065	0.024	50.38	8.82	1.02	485
0.140	0.035	49.01	5.73	1.07	932
0.224	0.040	48.09	4.04	1.15	1311
0.308	0.042	47.27	3.08	1.27	1590

[a] $u_{x1} = 0.001$, [b] $u_P = 0.1\%$ of measured value, and [c] $u_T = 0.1$ K.

Table S2. Parameters of the Wilson model, λ_{12}-λ_{11} and λ_{21}-λ_{22}, and standard deviations for the pressure σ_p for the [bmim]Br (1) + 1-butanol (2) system, obtained from the correlation of the VLE data

T/K	λ_{12}-λ_{11}/ (J mol^{-1})	λ_{21}-λ_{22}/ (J mol^{-1})	σ_P/kPa
353.15	5325.301	27250.05	0.10
363.15	3650.401	44733.61	0.09
373.15	3459.938	46614.48	0.07

Table S3. Experimental refractive indexes, n_D, and their deviations from ideality, n_D^E, vs. mole fraction of [bmim]Br x, for [bmim]Br (1) + 1-butanol (2) binary system

x [a]	n_D [b]	n_D^E [c]	x [a]	n_D [b]	n_D^E [c]
		[d] T = 298.15 K			
0	1.3973	0	0.584	1.4979	0.0200
0.094	1.4203	0.0100	0.667	1.5070	0.0176

0.193	1.4404	0.0165	0.779	1.5179	0.0132
0.271	1.4549	0.0203	0.818	1.5210	0.0108
0.345	1.4663	0.0214	1	1.5353	0
0.466	1.4834	0.0218			
		[d]T = 308.15 K			
0	1.3932	0	0.584	1.4949	0.0203
0.094	1.4166	0.0103	0.667	1.5040	0.0178
0.193	1.4369	0.0168	0.779	1.5149	0.0132
0.271	1.4515	0.0206	0.818	1.5181	0.0109
0.345	1.4630	0.0217	1	1.5326	0
0.466	1.4803	0.0221			

[a]u$_x$ = 0.001, [b]u$_{nD}$ = 0.0001, [c]$u_{n_D^E}$ = 0.0002, and [d]u$_T$ = 0.01 K.

Table S4. Redlich-Kister coefficients a_j [eq. (1)] and the standard deviations of the [bmim]Br composition σ_x and of the refractive index deviation $\sigma_{n_D^E}$ for [bmim]Br (1) + 1-butanol (2) binary system

T / K	a_0	a_1	a_2	σ_x	$\sigma_{n_D^E} \cdot 10^4$
298.15	0.0864	0.0266	0.0120	0.001	2.0
308.15	0.0875	0.0275	0.0123	0.001	1.9