Electronic Supplementary Information

The permittivity of thermodynamically ideal liquid mixtures and the excess relative permittivity of binary dielectrics

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Table S1. Experimental density ρ and relative permittivity ε_r of the pure liquids at different temperatures

Compound	T/K	ρ/g cm^{-3}	ε_r
Tetraglyme	283.15	1.02108	8.16
	288.15	1.01586	8.04
	298.15	1.00703	7.81
	308.15	0.99743	7.53
	328.15	0.97930	7.08
Hexane	288.15	0.66387	1.909
	308.15	0.64572	1.879
	328.15	0.62685	1.850
Cyclohexane	283.15	0.78787	2.056
	288.15	0.78329	2.049
	308.15	0.76438	2.018
Benzene	288.15	0.88424	2.316
	298.15	0.87358	2.296

Table S2. Experimental values of relative permittivity ε_r, excess relative permittivity ε_r^E and inverse vertical asymptote 1/p for mixtures tetraglyme(A)–hexane(B) as a function of mole fraction x_A and ideal volume fraction ϕ_A^{id} at different temperatures T

x_A	ϕ_A^{id}	ε_r	ε_r^E	1/p	x_A	ϕ_A^{id}	ε_r	ε_r^E	1/p
				T = 288.15 K					
0.0478	0.0782	2.167	−0.221	0.482	0.5988	0.7156	5.663	−0.633	0.372
0.0965	0.1526	2.453	−0.391	0.459	0.6935	0.7923	6.264	−0.502	0.357
0.1946	0.2894	3.051	−0.632	0.438	0.7974	0.8690	6.925	−0.312	0.322
0.2954	0.4141	3.701	−0.747	0.416	0.9000	0.9382	7.509	−0.152	0.305
0.3901	0.5188	4.313	−0.777	0.402	0.9520	0.9710	7.769	−0.093	0.353
0.4920	0.6201	4.990	−0.721	0.381					
				T = 308.15 K					
0.0480	0.0777	2.120	−0.197	0.469	0.5972	0.7123	5.423	−0.481	0.320
0.0999	0.1564	2.390	−0.373	0.464	0.6952	0.7920	5.988	−0.367	0.300
0.1942	0.2870	2.984	−0.516	0.396	0.7939	0.8655	6.534	−0.236	0.274
0.2970	0.4137	3.639	−0.578	0.359	0.9023	0.9391	7.097	−0.089	0.219
0.3958	0.5224	4.242	−0.589	0.343	0.9532	0.9714	7.349	−0.019	0.108
0.4897	0.6157	4.798	−0.560	0.333					
				T = 328.15 K					
0.0491	0.0786	2.113	−0.148	0.379	0.6000	0.7124	5.216	−0.360	0.271
0.1013	0.1569	2.402	−0.268	0.365	0.6943	0.7895	5.700	−0.279	0.256
0.1917	0.2814	2.900	−0.422	0.359	0.7995	0.8681	6.245	−0.145	0.200
0.2996	0.4139	3.518	−0.497	0.337	0.8941	0.9331	6.683	−0.047	0.127
0.3912	0.5148	4.047	−0.495	0.317	0.9523	0.9706	6.894	−0.032	0.177
0.4987	0.6216	4.664	−0.437	0.291					

Table S3. Experimental values of relative permittivity ε_r, excess relative permittivity ε_r^E and inverse vertical asymptote $1/p$ for mixtures tetraglyme(A)–cyclohexane(B) as a function of mole fraction x_A and ideal volume fraction ϕ_A^{id} at different temperatures T

x_A	ϕ_A^{id}	ε_r	ε_r^E	$1/p$	x_A	ϕ_A^{id}	ε_r	ε_r^E	$1/p$
				T = 283.15 K					
0.0505	0.0978	2.393	–0.260	0.461	0.6000	0.7535	6.119	–0.536	0.349
0.0985	0.1821	2.727	–0.441	0.446	0.6986	0.8253	6.679	–0.414	0.339
0.1945	0.3298	3.422	–0.655	0.418	0.8018	0.8918	7.210	–0.290	0.342
0.2999	0.4661	4.160	–0.741	0.397	0.9004	0.9485	7.720	–0.126	0.302
0.3980	0.5740	4.826	–0.734	0.384	0.9505	0.9751	7.960	–0.048	0.246
0.4990	0.6699	5.498	–0.647	0.363					
				T = 288.15 K					
0.0496	0.0961	2.375	–0.250	0.459	0.6041	0.7565	6.040	–0.541	0.358
0.1010	0.1862	2.722	–0.442	0.446	0.7039	0.8288	6.610	–0.404	0.341
0.1981	0.3347	3.408	–0.646	0.417	0.8061	0.8944	7.130	–0.277	0.340
0.3021	0.4685	4.140	–0.716	0.392	0.9018	0.9492	7.610	–0.136	0.333
0.4007	0.5766	4.789	–0.714	0.381	0.9542	0.9770	7.870	–0.032	0.193
0.4980	0.6689	5.410	–0.646	0.367					
				T = 308.15 K					
0.0517	0.0994	2.330	–0.236	0.457	0.5982	0.7508	5.650	–0.507	0.359
0.0981	0.1804	2.620	–0.392	0.442	0.7001	0.8253	6.170	–0.397	0.354
0.1973	0.3322	3.260	–0.589	0.415	0.8024	0.8915	6.670	–0.262	0.342
0.2941	0.4575	3.870	–0.669	0.400	0.9009	0.9485	7.120	–0.126	0.324
0.3975	0.5718	4.510	–0.660	0.382	0.9537	0.9766	7.340	–0.061	0.329
0.4946	0.6645	5.080	–0.601	0.369					

Table S4. Experimental values of relative permittivity ε_r, excess relative permittivity ε_r^E and inverse vertical asymptote $1/p$ for mixtures tetraglyme(A)–benzene(B) as a function of mole fraction x_A and ideal volume fraction ϕ_A^{id} at different temperatures T

x_A	ϕ_A^{id}	ε_r	ε_r^E	$1/p$	x_A	ϕ_A^{id}	ε_r	ε_r^E	$1/p$
				T = 288.15 K					
0.0479	0.1108	2.724	–0.227	0.385	0.6072	0.7929	6.492	–0.363	0.296
0.1025	0.2205	3.177	–0.402	0.375	0.7031	0.8543	6.970	–0.236	0.258
0.2044	0.3889	3.959	–0.583	0.367	0.7904	0.9033	7.360	–0.126	0.205
0.3053	0.5212	4.685	–0.614	0.351	0.9012	0.9576	7.843	0.046	–0.244
0.4045	0.6272	5.330	–0.576	0.339	0.9492	0.9789	7.999	0.080	–1.993
0.5047	0.7162	5.940	–0.476	0.316	0.9507	0.9795	8.011	0.088	–3.098
				T = 298.15 K					
0.0499	0.1148	2.702	–0.227	0.387	0.6041	0.7902	6.279	–0.374	0.309
0.1024	0.2197	3.134	–0.374	0.364	0.7059	0.8556	6.761	–0.253	0.282
0.2000	0.3816	3.870	–0.530	0.352	0.8065	0.9114	7.229	–0.093	0.176
0.3089	0.5246	4.620	–0.568	0.339	0.8935	0.9539	7.515	–0.041	0.146
0.4045	0.6264	5.190	–0.560	0.341	0.9512	0.9796	7.730	0.032	–0.408
0.5048	0.7156	5.770	–0.472	0.323					

Table S5. Values of inverse vertical asymptote $1/p$ for Wiener's lower bound, $(r_{A/B} - 1)/r_{A/B}$, and Hashin–Shtrikman's lower, $(r_{A/B} - 1)/(r_{A/B} + 2)$, and upper, $(r_{A/B} - 1)/3r_{A/B}$, bounds of the experimental systems

	tetraglyme(A)–hexane(B) at			tetraglyme(A)–cyclohexane(B) at			tetraglyme(A)–benzene(B) at	
$1/p$	288.15 K	308.15 K	328.15 K	283.15 K	288.15 K	308.15 K	288.15 K	298.15K
$(r_{A/B} - 1)/r_{A/B}$	0.763	0.750	0.739	0.748	0.745	0.732	0.712	0.706
$(r_{A/B} - 1)/(r_{A/B} + 2)$	0.517	0.501	0.485	0.497	0.494	0.477	0.452	0.445
$(r_{A/B} - 1)/3r_{A/B}$	0.254	0.250	0.246	0.249	0.248	0.244	0.237	0.253