

Supporting information

New experimental data and modeling of glymes: towards the development of a predictive model for Polyethers

Pablo Navarro^{†,‡,⊥}, Emanuel A. Crespo^{†,⊥}, João M. L. Costa[†], Felix Llovell[§], Julián García[‡], Francisco Rodríguez[‡], Pedro J. Carvalho^{†,*}, Lourdes F. Vega[¥] and João A. P. Coutinho[†]

[†] CICECO – Aveiro Institute of Materials, Department of Chemistry, University of Aveiro, 3810-193 Aveiro, Portugal

[‡] Department of Chemical Engineering, Faculty of Chemical Sciences, Complutense University of Madrid, 28040, Madrid, Spain

[§] Department of Chemical Engineering and Materials Science, IQS School of Engineering, Universitat Ramon Llull, Via Augusta, 390, 08017 Barcelona, Spain

[¥] Gas Research Center and Chemical Engineering Department. Khalifa University of Science and Technology – The Petroleum Institute, P.O. Box 2533. Abu Dhabi. United Arab Emirates

Corresponding author E-mail address: quijorge@ua.pt (P.J. Carvalho).

[⊥] P.N. and E.A.C. contributed equally

Index

Table S1. Density as function of temperature and pressure of the Ethylene glycol ethyl ether (EGEE).....	3
Table S2. Density as function of temperature and pressure of the Diethylene glycol methyl ether (DEGME).....	4
Table S3. Density as function of temperature and pressure of the Diethylene glycol ethyl ether (DEGEE).....	5
Table S4. Density as function of temperature and pressure of the Tetraethylene glycol methyl ether (TeEGME).....	6
Table S5. Density as function of temperature and pressure of the Diethylene glycol dimethyl ether (DEGDME).....	7
Table S6. Density as function of temperature and pressure of the Diethylene glycol diethyl ether (DEGDDEE).....	8
Table S7. Density as function of temperature and pressure of the Triethylene glycol dimethyl ether (TriEGDME).....	9
Table S8. Density as function of temperature and pressure of the Tetraethylene glycol dimethyl ether (TeEGDME).....	10

Table S1. Density as function of temperature and pressure of the Ethylene glycol ethyl ether (EGEE).

<i>T</i> /K																	
283.16		293.16		303.15		313.16		323.16		333.16		343.17		353.15		363.16	
<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³
0.1	0.9452	0.1	0.9362	0.1	0.9271	0.1	0.9181	0.1	0.9088	0.1	0.8992	0.1	0.8896	0.1	0.8796	0.1	0.8695
1.0	0.9459	1.0	0.9369	1.0	0.9278	1.0	0.9188	1.0	0.9095	1.0	0.9001	1.0	0.8905	1.0	0.8805	1.0	0.8705
2.0	0.9465	2.0	0.9376	2.0	0.9285	2.0	0.9196	2.0	0.9104	2.0	0.9010	2.0	0.8915	2.0	0.8816	2.0	0.8717
5.0	0.9486	5.0	0.9398	5.0	0.9308	5.0	0.9219	5.0	0.9129	5.0	0.9036	5.0	0.8940	5.0	0.8845	5.0	0.8746
7.0	0.9498	7.0	0.9412	7.0	0.9322	7.0	0.9231	7.0	0.9145	7.0	0.9053	7.0	0.8958	7.0	0.8865	7.0	0.8765
10.0	0.9518	10.0	0.9432	10.0	0.9343	10.0	0.9256	10.0	0.9167	10.0	0.9077	10.0	0.8983	10.0	0.8891	10.0	0.8795
12.0	0.9529	12.0	0.9442	12.0	0.9357	12.0	0.9270	12.0	0.9182	12.0	0.9093	12.0	0.9000	12.0	0.8908	12.0	0.8812
16.0	0.9553	16.0	0.9469	16.0	0.9383	16.0	0.9299	16.0	0.9212	16.0	0.9123	16.0	0.9033	16.0	0.8941	16.0	0.8849
20.0	0.9577	20.0	0.9494	20.0	0.9410	20.0	0.9327	20.0	0.9241	20.0	0.9153	20.0	0.9063	20.0	0.8975	20.0	0.8884
25.0	0.9606	25.0	0.9524	25.0	0.9440	25.0	0.9358	25.0	0.9275	25.0	0.9190	25.0	0.9098	25.0	0.9016	25.0	0.8926
30.0	0.9635	30.0	0.9552	30.0	0.9470	30.0	0.9391	30.0	0.9308	30.0	0.9219	30.0	0.9139	30.0	0.9051	30.0	0.8965
35.0	0.9660	35.0	0.9582	35.0	0.9500	35.0	0.9422	35.0	0.9340	35.0	0.9257	35.0	0.9172	35.0	0.9090	35.0	0.9003
40.0	0.9686	40.0	0.9609	40.0	0.9523	40.0	0.9453	40.0	0.9371	40.0	0.9290	40.0	0.9208	40.0	0.9125	40.0	0.9040
45.0	0.9713	45.0	0.9636	45.0	0.9554	45.0	0.9477	45.0	0.9401	45.0	0.9321	45.0	0.9239	45.0	0.9158	45.0	0.9076
50.0	0.9734	50.0	0.9661	50.0	0.9583	50.0	0.9508	50.0	0.9430	50.0	0.9350	50.0	0.9271	50.0	0.9192	50.0	0.9109
55.0	0.9761	55.0	0.9688	55.0	0.9608	55.0	0.9536	55.0	0.9458	55.0	0.9380	55.0	0.9305	55.0	0.9224	55.0	0.9141
60.0	0.9786	60.0	0.9711	60.0	0.9636	60.0	0.9561	60.0	0.9486	60.0	0.9409	60.0	0.9336	60.0	0.9257	60.0	0.9172
65.0	0.9810	65.0	0.9733	65.0	0.9662	65.0	0.9586	65.0	0.9512	65.0	0.9438	65.0	0.9359	65.0	0.9287	65.0	0.9203
70.0	0.9833	70.0	0.9756	70.0	0.9686	70.0	0.9612	70.0	0.9538	70.0	0.9465	70.0	0.9387	70.0	0.9314	70.0	0.9234
75.0	0.9856	75.0	0.9779	75.0	0.9710	75.0	0.9636	75.0	0.9563	75.0	0.9488	75.0	0.9412	75.0	0.9343	75.0	0.9265
80.0	0.9874	80.0	0.9803	80.0	0.9732	80.0	0.9660	80.0	0.9590	80.0	0.9517	80.0	0.9438	80.0	0.9371	80.0	0.9293
85.0	0.9899	85.0	0.9826	85.0	0.9755	85.0	0.9681	85.0	0.9613	85.0	0.9543	85.0	0.9467	85.0	0.9392	85.0	0.9321
90.0	0.9921	90.0	0.9846	90.0	0.9778	90.0	0.9709	90.0	0.9638	90.0	0.9567	90.0	0.9494	90.0	0.9424	90.0	0.9350
95.0	0.9938	95.0	0.9868	95.0	0.9800	95.0	0.9732	95.0	0.9663	95.0	0.9592	95.0	0.9519	95.0	0.9451	95.0	0.9376

Standard uncertainties u are $u(T) = 0.1$ K, $u(p) = 0.2\%$ and $u(\rho) = 5 \cdot 10^{-4}$ g.cm⁻³.

Table S2. Density as function of temperature and pressure of the Diethylene glycol methyl ether (DEGME).

<i>T</i> /K																	
283.17		293.16		303.17		313.15		323.14		333.14		343.16		353.17		363.17	
<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³
0.1	1.0284	0.1	1.0194	0.1	1.0107	0.1	1.0018	0.1	0.9929	0.1	0.9839	0.1	0.9746	0.1	0.9655	0.1	0.9562
1.0	1.0290	1.0	1.0201	1.0	1.0113	1.0	1.0025	1.0	0.9935	1.0	0.9846	1.0	0.9758	1.0	0.9663	1.0	0.9571
2.0	1.0295	2.0	1.0208	2.0	1.0120	2.0	1.0032	2.0	0.9943	2.0	0.9853	2.0	0.9763	2.0	0.9672	2.0	0.9578
5.0	1.0313	5.0	1.0226	5.0	1.0139	5.0	1.0052	5.0	0.9964	5.0	0.9875	5.0	0.9785	5.0	0.9696	5.0	0.9605
7.0	1.0325	7.0	1.0238	7.0	1.0152	7.0	1.0065	7.0	0.9977	7.0	0.9888	7.0	0.9799	7.0	0.9712	7.0	0.9621
10.0	1.0340	10.0	1.0256	10.0	1.0170	10.0	1.0083	10.0	0.9997	10.0	0.9909	10.0	0.9821	10.0	0.9734	10.0	0.9644
12.0	1.0351	12.0	1.0267	12.0	1.0181	12.0	1.0095	12.0	1.0009	12.0	0.9922	12.0	0.9835	12.0	0.9748	12.0	0.9658
16.0	1.0373	16.0	1.0289	16.0	1.0205	16.0	1.0119	16.0	1.0035	16.0	0.9948	16.0	0.9864	16.0	0.9777	16.0	0.9690
20.0	1.0392	20.0	1.0309	20.0	1.0226	20.0	1.0143	20.0	1.0058	20.0	0.9973	20.0	0.9890	20.0	0.9805	20.0	0.9720
25.0	1.0416	25.0	1.0336	25.0	1.0253	25.0	1.0170	25.0	1.0089	25.0	1.0005	25.0	0.9922	25.0	0.9840	25.0	0.9755
30.0	1.0442	30.0	1.0361	30.0	1.0281	30.0	1.0199	30.0	1.0117	30.0	1.0036	30.0	0.9955	30.0	0.9872	30.0	0.9789
35.0	1.0468	35.0	1.0386	35.0	1.0306	35.0	1.0225	35.0	1.0145	35.0	1.0067	35.0	0.9984	35.0	0.9904	35.0	0.9823
40.0	1.0492	40.0	1.0412	40.0	1.0332	40.0	1.0252	40.0	1.0173	40.0	1.0095	40.0	1.0012	40.0	0.9934	40.0	0.9856
45.0	1.0516	45.0	1.0435	45.0	1.0357	45.0	1.0279	45.0	1.0200	45.0	1.0121	45.0	1.0042	45.0	0.9963	45.0	0.9887
50.0	1.0535	50.0	1.0459	50.0	1.0382	50.0	1.0305	50.0	1.0224	50.0	1.0149	50.0	1.0069	50.0	0.9993	50.0	0.9916
55.0	1.0553	55.0	1.0481	55.0	1.0405	55.0	1.0329	55.0	1.0249	55.0	1.0176	55.0	1.0099	55.0	1.0022	55.0	0.9945
60.0	1.0581	60.0	1.0504	60.0	1.0429	60.0	1.0352	60.0	1.0275	60.0	1.0201	60.0	1.0126	60.0	1.0051	60.0	0.9972
65.0	1.0603	65.0	1.0527	65.0	1.0450	65.0	1.0376	65.0	1.0301	65.0	1.0225	65.0	1.0151	65.0	1.0077	65.0	1.0000
70.0	1.0622	70.0	1.0549	70.0	1.0474	70.0	1.0399	70.0	1.0325	70.0	1.0250	70.0	1.0178	70.0	1.0104	70.0	1.0025
75.0	1.0645	75.0	1.0570	75.0	1.0498	75.0	1.0421	75.0	1.0349	75.0	1.0276	75.0	1.0204	75.0	1.0125	75.0	1.0056
80.0	1.0664	80.0	1.0593	80.0	1.0518	80.0	1.0444	80.0	1.0371	80.0	1.0300	80.0	1.0228	80.0	1.0156	80.0	1.0083
85.0	1.0684	85.0	1.0614	85.0	1.0540	85.0	1.0468	85.0	1.0395	85.0	1.0323	85.0	1.0252	85.0	1.0182	85.0	1.0109
90.0	1.0701	90.0	1.0634	90.0	1.0562	90.0	1.0490	90.0	1.0417	90.0	1.0347	90.0	1.0276	90.0	1.0206	90.0	1.0133
95.0	1.0725	95.0	1.0655	95.0	1.0582	95.0	1.0511	95.0	1.0440	95.0	1.0368	95.0	1.0300	95.0	1.0229	95.0	1.0157

Standard uncertainties u are $u(T) = 0.1$ K, $u(p) = 0.2\%$ and $u(\rho) = 5 \cdot 10^{-4}$ g.cm⁻³.

Table S3. Density as function of temperature and pressure of the Diethylene glycol ethyl ether (DEGEE).

<i>T</i> /K																	
283.15		293.17		303.15		313.16		323.15		333.17		343.16		353.14		363.15	
<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³
0.1	0.9960	0.1	0.9873	0.1	0.9784	0.1	0.9693	0.1	0.9605	0.1	0.9512	0.1	0.9419	0.1	0.9327	0.1	0.9234
1.0	0.9966	1.0	0.9879	1.0	0.9791	1.0	0.9699	1.0	0.9612	1.0	0.9520	1.0	0.9428	1.0	0.9335	1.0	0.9243
2.0	0.9972	2.0	0.9885	2.0	0.9798	2.0	0.9706	2.0	0.9620	2.0	0.9527	2.0	0.9437	2.0	0.9346	2.0	0.9253
5.0	0.9990	5.0	0.9906	5.0	0.9819	5.0	0.9729	5.0	0.9637	5.0	0.9551	5.0	0.9462	5.0	0.9373	5.0	0.9280
7.0	1.0002	7.0	0.9918	7.0	0.9832	7.0	0.9742	7.0	0.9657	7.0	0.9567	7.0	0.9478	7.0	0.9390	7.0	0.9298
10.0	1.0018	10.0	0.9937	10.0	0.9851	10.0	0.9762	10.0	0.9679	10.0	0.9585	10.0	0.9502	10.0	0.9413	10.0	0.9324
12.0	1.0030	12.0	0.9948	12.0	0.9861	12.0	0.9775	12.0	0.9692	12.0	0.9601	12.0	0.9516	12.0	0.9429	12.0	0.9338
16.0	1.0054	16.0	0.9971	16.0	0.9886	16.0	0.9801	16.0	0.9719	16.0	0.9630	16.0	0.9545	16.0	0.9460	16.0	0.9371
20.0	1.0074	20.0	0.9993	20.0	0.9911	20.0	0.9826	20.0	0.9744	20.0	0.9657	20.0	0.9574	20.0	0.9488	20.0	0.9401
25.0	1.0100	25.0	1.0022	25.0	0.9938	25.0	0.9856	25.0	0.9770	25.0	0.9687	25.0	0.9608	25.0	0.9524	25.0	0.9438
30.0	1.0127	30.0	1.0048	30.0	0.9967	30.0	0.9885	30.0	0.9802	30.0	0.9715	30.0	0.9641	30.0	0.9560	30.0	0.9475
35.0	1.0151	35.0	1.0068	35.0	0.9993	35.0	0.9910	35.0	0.9832	35.0	0.9753	35.0	0.9672	35.0	0.9593	35.0	0.9510
40.0	1.0177	40.0	1.0098	40.0	1.0021	40.0	0.9936	40.0	0.9862	40.0	0.9778	40.0	0.9704	40.0	0.9623	40.0	0.9544
45.0	1.0200	45.0	1.0123	45.0	1.0046	45.0	0.9964	45.0	0.9890	45.0	0.9810	45.0	0.9735	45.0	0.9654	45.0	0.9577
50.0	1.0224	50.0	1.0149	50.0	1.0072	50.0	0.9990	50.0	0.9917	50.0	0.9840	50.0	0.9763	50.0	0.9686	50.0	0.9608
55.0	1.0247	55.0	1.0172	55.0	1.0095	55.0	1.0018	55.0	0.9943	55.0	0.9867	55.0	0.9792	55.0	0.9712	55.0	0.9637
60.0	1.0269	60.0	1.0195	60.0	1.0120	60.0	1.0045	60.0	0.9971	60.0	0.9891	60.0	0.9820	60.0	0.9743	60.0	0.9668
65.0	1.0293	65.0	1.0219	65.0	1.0144	65.0	1.0070	65.0	0.9993	65.0	0.9917	65.0	0.9848	65.0	0.9772	65.0	0.9697
70.0	1.0315	70.0	1.0240	70.0	1.0169	70.0	1.0092	70.0	1.0019	70.0	0.9945	70.0	0.9873	70.0	0.9800	70.0	0.9725
75.0	1.0337	75.0	1.0264	75.0	1.0188	75.0	1.0117	75.0	1.0044	75.0	0.9964	75.0	0.9899	75.0	0.9825	75.0	0.9751
80.0	1.0358	80.0	1.0286	80.0	1.0211	80.0	1.0141	80.0	1.0062	80.0	0.9988	80.0	0.9925	80.0	0.9852	80.0	0.9779
85.0	1.0379	85.0	1.0308	85.0	1.0234	85.0	1.0164	85.0	1.0090	85.0	1.0017	85.0	0.9950	85.0	0.9878	85.0	0.9806
90.0	1.0398	90.0	1.0329	90.0	1.0256	90.0	1.0185	90.0	1.0114	90.0	1.0043	90.0	0.9974	90.0	0.9904	90.0	0.9833
95.0	1.0419	95.0	1.0348	95.0	1.0278	95.0	1.0208	95.0	1.0137	95.0	1.0066	95.0	0.9998	95.0	0.9929	95.0	0.9856

Standard uncertainties u are $u(T) = 0.1$ K, $u(p) = 0.2\%$ and $u(\rho) = 5 \cdot 10^{-4}$ g.cm⁻³.

Table S4. Density as function of temperature and pressure of the Tetraethylene glycol methyl ether (TeEGME).

<i>T</i> /K																	
283.14		293.16		303.15		313.15		323.18		333.15		343.15		353.15		363.14	
<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³
0.1	1.0705	0.1	1.0616	0.1	1.0530	0.1	1.0445	0.1	1.0357	0.1	1.0271	0.1	1.0181	0.1	1.0095	0.1	1.0006
1.0	1.0710	1.0	1.0622	1.0	1.0536	1.0	1.0451	1.0	1.0362	1.0	1.0277	1.0	1.0188	1.0	1.0101	1.0	1.0013
2.0	1.0715	2.0	1.0628	2.0	1.0542	2.0	1.0456	2.0	1.0369	2.0	1.0283	2.0	1.0196	2.0	1.0109	2.0	1.0021
5.0	1.0731	5.0	1.0644	5.0	1.0560	5.0	1.0475	5.0	1.0388	5.0	1.0304	5.0	1.0216	5.0	1.0131	5.0	1.0044
7.0	1.0741	7.0	1.0655	7.0	1.0570	7.0	1.0487	7.0	1.0400	7.0	1.0316	7.0	1.0230	7.0	1.0145	7.0	1.0059
10.0	1.0755	10.0	1.0672	10.0	1.0588	10.0	1.0503	10.0	1.0419	10.0	1.0335	10.0	1.0251	10.0	1.0165	10.0	1.0080
12.0	1.0765	12.0	1.0682	12.0	1.0598	12.0	1.0515	12.0	1.0431	12.0	1.0346	12.0	1.0263	12.0	1.0177	12.0	1.0094
16.0	1.0785	16.0	1.0703	16.0	1.0621	16.0	1.0538	16.0	1.0453	16.0	1.0371	16.0	1.0290	16.0	1.0205	16.0	1.0122
20.0	1.0806	20.0	1.0724	20.0	1.0640	20.0	1.0559	20.0	1.0476	20.0	1.0396	20.0	1.0313	20.0	1.0230	20.0	1.0149
25.0	1.0830	25.0	1.0749	25.0	1.0666	25.0	1.0586	25.0	1.0505	25.0	1.0425	25.0	1.0343	25.0	1.0262	25.0	1.0179
30.0	1.0854	30.0	1.0774	30.0	1.0693	30.0	1.0612	30.0	1.0532	30.0	1.0453	30.0	1.0375	30.0	1.0293	30.0	1.0213
35.0	1.0877	35.0	1.0798	35.0	1.0717	35.0	1.0638	35.0	1.0558	35.0	1.0481	35.0	1.0404	35.0	1.0320	35.0	1.0245
40.0	1.0898	40.0	1.0821	40.0	1.0742	40.0	1.0663	40.0	1.0584	40.0	1.0506	40.0	1.0431	40.0	1.0350	40.0	1.0274
45.0	1.0920	45.0	1.0845	45.0	1.0765	45.0	1.0687	45.0	1.0609	45.0	1.0533	45.0	1.0457	45.0	1.0378	45.0	1.0303
50.0	1.0943	50.0	1.0866	50.0	1.0788	50.0	1.0711	50.0	1.0634	50.0	1.0560	50.0	1.0482	50.0	1.0406	50.0	1.0331
55.0	1.0964	55.0	1.0888	55.0	1.0809	55.0	1.0735	55.0	1.0659	55.0	1.0574	55.0	1.0508	55.0	1.0432	55.0	1.0355
60.0	1.0985	60.0	1.0909	60.0	1.0830	60.0	1.0757	60.0	1.0683	60.0	1.0609	60.0	1.0534	60.0	1.0457	60.0	1.0384
65.0	1.1006	65.0	1.0932	65.0	1.0853	65.0	1.0780	65.0	1.0706	65.0	1.0631	65.0	1.0560	65.0	1.0482	65.0	1.0411
70.0	1.1027	70.0	1.0952	70.0	1.0874	70.0	1.0801	70.0	1.0729	70.0	1.0656	70.0	1.0583	70.0	1.0507	70.0	1.0436
75.0	1.1045	75.0	1.0972	75.0	1.0896	75.0	1.0824	75.0	1.0750	75.0	1.0678	75.0	1.0607	75.0	1.0533	75.0	1.0463
80.0	1.1063	80.0	1.0992	80.0	1.0917	80.0	1.0845	80.0	1.0773	80.0	1.0701	80.0	1.0629	80.0	1.0557	80.0	1.0488
85.0	1.1084	85.0	1.1011	85.0	1.0938	85.0	1.0866	85.0	1.0795	85.0	1.0724	85.0	1.0653	85.0	1.0582	85.0	1.0509
90.0	1.1102	90.0	1.1031	90.0	1.0957	90.0	1.0884	90.0	1.0817	90.0	1.0746	90.0	1.0674	90.0	1.0605	90.0	1.0535
95.0	1.1117	95.0	1.1050	95.0	1.0978	95.0	1.0905	95.0	1.0838	95.0	1.0769	95.0	1.0696	95.0	1.0629	95.0	1.0559

Standard uncertainties u are $u(T) = 0.1$ K, $u(p) = 0.2\%$ and $u(\rho) = 5 \cdot 10^{-4}$ g.cm⁻³.

Table S5. Density as function of temperature and pressure of the Diethylene glycol dimethyl ether (DEGDME).

<i>T</i> /K																	
283.13		293.11		303.14		313.13		323.11		333.14		343.12		353.14		363.12	
<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³
0.1	0.9529	0.1	0.9431	0.1	0.9333	0.1	0.9231	0.1	0.9135	0.1	0.9033	0.1	0.8931	0.1	0.8825	0.1	0.8722
1.0	0.9537	1.0	0.9437	1.0	0.9341	1.0	0.9238	1.0	0.9143	1.0	0.9045	1.0	0.8942	1.0	0.8837	1.0	0.8733
2.0	0.9543	2.0	0.9446	2.0	0.9349	2.0	0.9247	2.0	0.9153	2.0	0.9055	2.0	0.8951	2.0	0.8849	2.0	0.8746
5.0	0.9565	5.0	0.9468	5.0	0.9373	5.0	0.9272	5.0	0.9179	5.0	0.9082	5.0	0.8982	5.0	0.8881	5.0	0.8781
7.0	0.9578	7.0	0.9482	7.0	0.9387	7.0	0.9288	7.0	0.9195	7.0	0.9101	7.0	0.9002	7.0	0.8902	7.0	0.8802
10.0	0.9598	10.0	0.9503	10.0	0.9410	10.0	0.9313	10.0	0.9221	10.0	0.9128	10.0	0.9030	10.0	0.8929	10.0	0.8833
12.0	0.9611	12.0	0.9518	12.0	0.9425	12.0	0.9328	12.0	0.9238	12.0	0.9145	12.0	0.9048	12.0	0.8951	12.0	0.8853
16.0	0.9638	16.0	0.9546	16.0	0.9454	16.0	0.9358	16.0	0.9271	16.0	0.9180	16.0	0.9085	16.0	0.8987	16.0	0.8895
20.0	0.9662	20.0	0.9572	20.0	0.9482	20.0	0.9388	20.0	0.9301	20.0	0.9213	20.0	0.9119	20.0	0.9025	20.0	0.8933
25.0	0.9694	25.0	0.9604	25.0	0.9516	25.0	0.9424	25.0	0.9339	25.0	0.9250	25.0	0.9161	25.0	0.9068	25.0	0.8979
30.0	0.9724	30.0	0.9635	30.0	0.9550	30.0	0.9458	30.0	0.9374	30.0	0.9291	30.0	0.9199	30.0	0.9109	30.0	0.9021
35.0	0.9753	35.0	0.9667	35.0	0.9581	35.0	0.9491	35.0	0.9409	35.0	0.9325	35.0	0.9239	35.0	0.9149	35.0	0.9063
40.0	0.9781	40.0	0.9695	40.0	0.9612	40.0	0.9524	40.0	0.9443	40.0	0.9358	40.0	0.9275	40.0	0.9188	40.0	0.9104
45.0	0.9808	45.0	0.9723	45.0	0.9642	45.0	0.9555	45.0	0.9476	45.0	0.9393	45.0	0.9309	45.0	0.9225	45.0	0.9141
50.0	0.9834	50.0	0.9752	50.0	0.9671	50.0	0.9585	50.0	0.9507	50.0	0.9426	50.0	0.9344	50.0	0.9260	50.0	0.9178
55.0	0.9861	55.0	0.9780	55.0	0.9700	55.0	0.9615	55.0	0.9538	55.0	0.9458	55.0	0.9377	55.0	0.9295	55.0	0.9214
60.0	0.9886	60.0	0.9807	60.0	0.9727	60.0	0.9646	60.0	0.9569	60.0	0.9490	60.0	0.9410	60.0	0.9328	60.0	0.9249
65.0	0.9911	65.0	0.9833	65.0	0.9754	65.0	0.9672	65.0	0.9599	65.0	0.9520	65.0	0.9441	65.0	0.9361	65.0	0.9284
70.0	0.9937	70.0	0.9859	70.0	0.9781	70.0	0.9700	70.0	0.9629	70.0	0.9550	70.0	0.9472	70.0	0.9393	70.0	0.9316
75.0	0.9960	75.0	0.9884	75.0	0.9807	75.0	0.9729	75.0	0.9656	75.0	0.9579	75.0	0.9502	75.0	0.9423	75.0	0.9348
80.0	0.9984	80.0	0.9909	80.0	0.9832	80.0	0.9755	80.0	0.9681	80.0	0.9608	80.0	0.9532	80.0	0.9454	80.0	0.9380
85.0	1.0006	85.0	0.9932	85.0	0.9853	85.0	0.9781	85.0	0.9707	85.0	0.9635	85.0	0.9559	85.0	0.9484	85.0	0.9410
90.0	1.0029	90.0	0.9954	90.0	0.9877	90.0	0.9806	90.0	0.9734	90.0	0.9663	90.0	0.9588	90.0	0.9514	90.0	0.9439
95.0	1.0052	95.0	0.9977	95.0	0.9901	95.0	0.9830	95.0	0.9759	95.0	0.9688	95.0	0.9615	95.0	0.9541	95.0	0.9468

Standard uncertainties *u* are $u(T) = 0.1$ K, $u(p) = 0.2\%$ and $u(\rho) = 5 \cdot 10^{-4}$ g.cm⁻³.

Table S6. Density as function of temperature and pressure of the Diethylene glycol diethyl ether (DEGDDE).

<i>T</i> /K																	
283.16		293.16		303.15		313.16		323.17		333.15		343.17		353.16		363.15	
<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³
0.1	0.9160	0.1	0.9065	0.1	0.8969	0.1	0.8873	0.1	0.8772	0.1	0.8676	0.1	0.8579	0.1	0.8480	0.1	0.8375
1.0	0.9166	1.0	0.9072	1.0	0.8978	1.0	0.8881	1.0	0.8782	1.0	0.8686	1.0	0.8589	1.0	0.8490	1.0	0.8391
2.0	0.9174	2.0	0.9080	2.0	0.8986	2.0	0.8890	2.0	0.8793	2.0	0.8696	2.0	0.8600	2.0	0.8503	2.0	0.8404
5.0	0.9196	5.0	0.9105	5.0	0.9011	5.0	0.8917	5.0	0.8822	5.0	0.8727	5.0	0.8632	5.0	0.8537	5.0	0.8441
7.0	0.9211	7.0	0.9119	7.0	0.9028	7.0	0.8934	7.0	0.8840	7.0	0.8746	7.0	0.8652	7.0	0.8558	7.0	0.8464
10.0	0.9232	10.0	0.9140	10.0	0.9051	10.0	0.8959	10.0	0.8866	10.0	0.8773	10.0	0.8681	10.0	0.8589	10.0	0.8496
12.0	0.9244	12.0	0.9154	12.0	0.9065	12.0	0.8974	12.0	0.8882	12.0	0.8790	12.0	0.8699	12.0	0.8608	12.0	0.8516
16.0	0.9271	16.0	0.9184	16.0	0.9096	16.0	0.9005	16.0	0.8914	16.0	0.8826	16.0	0.8735	16.0	0.8648	16.0	0.8559
20.0	0.9298	20.0	0.9210	20.0	0.9125	20.0	0.9036	20.0	0.8946	20.0	0.8857	20.0	0.8772	20.0	0.8685	20.0	0.8596
25.0	0.9330	25.0	0.9244	25.0	0.9158	25.0	0.9074	25.0	0.8985	25.0	0.8898	25.0	0.8812	25.0	0.8728	25.0	0.8643
30.0	0.9360	30.0	0.9276	30.0	0.9192	30.0	0.9108	30.0	0.9022	30.0	0.8937	30.0	0.8852	30.0	0.8771	30.0	0.8688
35.0	0.9391	35.0	0.9309	35.0	0.9225	35.0	0.9141	35.0	0.9057	35.0	0.8973	35.0	0.8893	35.0	0.8813	35.0	0.8729
40.0	0.9420	40.0	0.9337	40.0	0.9256	40.0	0.9175	40.0	0.9091	40.0	0.9009	40.0	0.8931	40.0	0.8852	40.0	0.8770
45.0	0.9449	45.0	0.9366	45.0	0.9287	45.0	0.9205	45.0	0.9125	45.0	0.9045	45.0	0.8966	45.0	0.8890	45.0	0.8808
50.0	0.9476	50.0	0.9396	50.0	0.9317	50.0	0.9236	50.0	0.9156	50.0	0.9079	50.0	0.9001	50.0	0.8925	50.0	0.8848
55.0	0.9502	55.0	0.9423	55.0	0.9346	55.0	0.9266	55.0	0.9188	55.0	0.9111	55.0	0.9036	55.0	0.8961	55.0	0.8885
60.0	0.9529	60.0	0.9451	60.0	0.9374	60.0	0.9295	60.0	0.9219	60.0	0.9144	60.0	0.9069	60.0	0.8993	60.0	0.8921
65.0	0.9554	65.0	0.9478	65.0	0.9400	65.0	0.9323	65.0	0.9247	65.0	0.9174	65.0	0.9101	65.0	0.9027	65.0	0.8955
70.0	0.9579	70.0	0.9503	70.0	0.9428	70.0	0.9352	70.0	0.9275	70.0	0.9203	70.0	0.9131	70.0	0.9058	70.0	0.8986
75.0	0.9603	75.0	0.9529	75.0	0.9454	75.0	0.9379	75.0	0.9303	75.0	0.9232	75.0	0.9161	75.0	0.9090	75.0	0.9019
80.0	0.9627	80.0	0.9552	80.0	0.9479	80.0	0.9405	80.0	0.9332	80.0	0.9259	80.0	0.9190	80.0	0.9119	80.0	0.9051
85.0	0.9649	85.0	0.9577	85.0	0.9504	85.0	0.9432	85.0	0.9359	85.0	0.9288	85.0	0.9219	85.0	0.9149	85.0	0.9081
90.0	0.9671	90.0	0.9601	90.0	0.9528	90.0	0.9456	90.0	0.9385	90.0	0.9316	90.0	0.9247	90.0	0.9178	90.0	0.9112
95.0	0.9694	95.0	0.9625	95.0	0.9552	95.0	0.9481	95.0	0.9410	95.0	0.9342	95.0	0.9274	95.0	0.9206	95.0	0.9142

Standard uncertainties u are $u(T) = 0.1$ K, $u(p) = 0.2\%$ and $u(\rho) = 5 \cdot 10^{-4}$ g.cm⁻³.

Table S7. Density as function of temperature and pressure of the Triethylene glycol dimethyl ether (TriEGDME).

<i>T</i> /K																	
283.12		293.13		303.13		313.13		323.17		333.16		343.13		353.14		363.13	
<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³
0.1	0.9938	0.1	0.9845	0.1	0.9752	0.1	0.9658	0.1	0.9563	0.1	0.9467	0.1	0.9372	0.1	0.9268	0.1	0.9174
1.0	0.9945	1.0	0.9851	1.0	0.9759	1.0	0.9664	1.0	0.9569	1.0	0.9475	1.0	0.9380	1.0	0.9282	1.0	0.9184
2.0	0.9951	2.0	0.9858	2.0	0.9765	2.0	0.9672	2.0	0.9578	2.0	0.9484	2.0	0.9389	2.0	0.9291	2.0	0.9195
5.0	0.9971	5.0	0.9878	5.0	0.9787	5.0	0.9694	5.0	0.9601	5.0	0.9508	5.0	0.9415	5.0	0.9319	5.0	0.9223
7.0	0.9983	7.0	0.9891	7.0	0.9801	7.0	0.9708	7.0	0.9616	7.0	0.9525	7.0	0.9431	7.0	0.9337	7.0	0.9242
10.0	1.0001	10.0	0.9910	10.0	0.9821	10.0	0.9730	10.0	0.9638	10.0	0.9548	10.0	0.9456	10.0	0.9362	10.0	0.9269
12.0	1.0013	12.0	0.9923	12.0	0.9834	12.0	0.9744	12.0	0.9653	12.0	0.9563	12.0	0.9473	12.0	0.9381	12.0	0.9288
16.0	1.0036	16.0	0.9948	16.0	0.9860	16.0	0.9771	16.0	0.9683	16.0	0.9595	16.0	0.9505	16.0	0.9414	16.0	0.9323
20.0	1.0060	20.0	0.9972	20.0	0.9886	20.0	0.9798	20.0	0.9710	20.0	0.9623	20.0	0.9536	20.0	0.9446	20.0	0.9356
25.0	1.0088	25.0	1.0001	25.0	0.9916	25.0	0.9830	25.0	0.9744	25.0	0.9659	25.0	0.9572	25.0	0.9485	25.0	0.9397
30.0	1.0116	30.0	1.0030	30.0	0.9945	30.0	0.9862	30.0	0.9778	30.0	0.9692	30.0	0.9608	30.0	0.9521	30.0	0.9436
35.0	1.0143	35.0	1.0059	35.0	0.9975	35.0	0.9892	35.0	0.9810	35.0	0.9725	35.0	0.9643	35.0	0.9558	35.0	0.9474
40.0	1.0169	40.0	1.0086	40.0	1.0003	40.0	0.9922	40.0	0.9840	40.0	0.9758	40.0	0.9675	40.0	0.9593	40.0	0.9510
45.0	1.0195	45.0	1.0113	45.0	1.0031	45.0	0.9951	45.0	0.9870	45.0	0.9789	45.0	0.9709	45.0	0.9628	45.0	0.9545
50.0	1.0220	50.0	1.0141	50.0	1.0058	50.0	0.9979	50.0	0.9899	50.0	0.9820	50.0	0.9740	50.0	0.9661	50.0	0.9579
55.0	1.0244	55.0	1.0165	55.0	1.0084	55.0	1.0007	55.0	0.9926	55.0	0.9849	55.0	0.9772	55.0	0.9692	55.0	0.9613
60.0	1.0269	60.0	1.0190	60.0	1.0111	60.0	1.0034	60.0	0.9956	60.0	0.9878	60.0	0.9801	60.0	0.9723	60.0	0.9644
65.0	1.0292	65.0	1.0214	65.0	1.0137	65.0	1.0060	65.0	0.9982	65.0	0.9906	65.0	0.9831	65.0	0.9755	65.0	0.9676
70.0	1.0315	70.0	1.0238	70.0	1.0161	70.0	1.0085	70.0	1.0010	70.0	0.9934	70.0	0.9859	70.0	0.9782	70.0	0.9706
75.0	1.0338	75.0	1.0263	75.0	1.0186	75.0	1.0110	75.0	1.0036	75.0	0.9961	75.0	0.9888	75.0	0.9812	75.0	0.9736
80.0	1.0361	80.0	1.0284	80.0	1.0210	80.0	1.0135	80.0	1.0062	80.0	0.9988	80.0	0.9915	80.0	0.9841	80.0	0.9765
85.0	1.0382	85.0	1.0307	85.0	1.0233	85.0	1.0160	85.0	1.0086	85.0	1.0013	85.0	0.9942	85.0	0.9867	85.0	0.9794
90.0	1.0404	90.0	1.0329	90.0	1.0256	90.0	1.0183	90.0	1.0110	90.0	1.0038	90.0	0.9966	90.0	0.9893	90.0	0.9823
95.0	1.0424	95.0	1.0351	95.0	1.0277	95.0	1.0206	95.0	1.0135	95.0	1.0063	95.0	0.9992	95.0	0.9920	95.0	0.9849

Standard uncertainties u are $u(T) = 0.1$ K, $u(p) = 0.2\%$ and $u(\rho) = 5 \cdot 10^{-4}$ g.cm⁻³.

Table S8. Density as function of temperature and pressure of the Tetraethylene glycol dimethyl ether (TeEGDME).

<i>T</i> /K																	
283.17		293.16		303.12		313.12		323.15		333.19		343.15		353.17		363.15	
<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³	<i>p</i> /MPa	ρ /g.cm ⁻³
0.1	1.0198	0.1	1.0106	0.1	1.0014	0.1	0.9922	0.1	0.9830	0.1	0.9739	0.1	0.9645	0.1	0.9553	0.1	0.9458
1.0	1.0204	1.0	1.0112	1.0	1.0020	1.0	0.9929	1.0	0.9837	1.0	0.9746	1.0	0.9652	1.0	0.9561	1.0	0.9466
2.0	1.0209	2.0	1.0118	2.0	1.0027	2.0	0.9936	2.0	0.9843	2.0	0.9754	2.0	0.9661	2.0	0.9569	2.0	0.9476
5.0	1.0228	5.0	1.0137	5.0	1.0046	5.0	0.9957	5.0	0.9867	5.0	0.9777	5.0	0.9685	5.0	0.9594	5.0	0.9501
7.0	1.0239	7.0	1.0149	7.0	1.0060	7.0	0.9971	7.0	0.9881	7.0	0.9790	7.0	0.9700	7.0	0.9611	7.0	0.9520
10.0	1.0257	10.0	1.0167	10.0	1.0078	10.0	0.9990	10.0	0.9902	10.0	0.9812	10.0	0.9725	10.0	0.9635	10.0	0.9545
12.0	1.0269	12.0	1.0179	12.0	1.0091	12.0	1.0003	12.0	0.9916	12.0	0.9828	12.0	0.9741	12.0	0.9650	12.0	0.9562
16.0	1.0291	16.0	1.0203	16.0	1.0116	16.0	1.0030	16.0	0.9942	16.0	0.9855	16.0	0.9770	16.0	0.9681	16.0	0.9594
20.0	1.0313	20.0	1.0226	20.0	1.0140	20.0	1.0055	20.0	0.9969	20.0	0.9883	20.0	0.9799	20.0	0.9711	20.0	0.9625
25.0	1.0341	25.0	1.0254	25.0	1.0169	25.0	1.0085	25.0	1.0001	25.0	0.9916	25.0	0.9834	25.0	0.9748	25.0	0.9663
30.0	1.0367	30.0	1.0281	30.0	1.0197	30.0	1.0115	30.0	1.0033	30.0	0.9949	30.0	0.9867	30.0	0.9782	30.0	0.9700
35.0	1.0392	35.0	1.0308	35.0	1.0225	35.0	1.0144	35.0	1.0062	35.0	0.9981	35.0	0.9900	35.0	0.9816	35.0	0.9735
40.0	1.0417	40.0	1.0334	40.0	1.0252	40.0	1.0172	40.0	1.0092	40.0	1.0011	40.0	0.9932	40.0	0.9850	40.0	0.9769
45.0	1.0442	45.0	1.0359	45.0	1.0279	45.0	1.0199	45.0	1.0120	45.0	1.0041	45.0	0.9963	45.0	0.9881	45.0	0.9802
50.0	1.0467	50.0	1.0384	50.0	1.0305	50.0	1.0226	50.0	1.0149	50.0	1.0069	50.0	0.9992	50.0	0.9913	50.0	0.9834
55.0	1.0491	55.0	1.0409	55.0	1.0330	55.0	1.0253	55.0	1.0176	55.0	1.0097	55.0	1.0021	55.0	0.9942	55.0	0.9866
60.0	1.0513	60.0	1.0433	60.0	1.0354	60.0	1.0279	60.0	1.0202	60.0	1.0124	60.0	1.0051	60.0	0.9972	60.0	0.9897
65.0	1.0535	65.0	1.0456	65.0	1.0379	65.0	1.0303	65.0	1.0228	65.0	1.0152	65.0	1.0079	65.0	1.0000	65.0	0.9927
70.0	1.0558	70.0	1.0479	70.0	1.0403	70.0	1.0327	70.0	1.0254	70.0	1.0178	70.0	1.0105	70.0	1.0027	70.0	0.9956
75.0	1.0579	75.0	1.0502	75.0	1.0426	75.0	1.0352	75.0	1.0279	75.0	1.0204	75.0	1.0131	75.0	1.0054	75.0	0.9984
80.0	1.0601	80.0	1.0524	80.0	1.0449	80.0	1.0376	80.0	1.0303	80.0	1.0229	80.0	1.0157	80.0	1.0082	80.0	1.0011
85.0	1.0622	85.0	1.0545	85.0	1.0471	85.0	1.0399	85.0	1.0327	85.0	1.0253	85.0	1.0183	85.0	1.0109	85.0	1.0039
90.0	1.0643	90.0	1.0567	90.0	1.0494	90.0	1.0422	90.0	1.0350	90.0	1.0279	90.0	1.0207	90.0	1.0138	90.0	1.0065
95.0	1.0663	95.0	1.0588	95.0	1.0515	95.0	1.0444	95.0	1.0374	95.0	1.0302	95.0	1.0232	95.0	1.0162	95.0	1.0092

Standard uncertainties u are $u(T) = 0.1$ K, $u(p) = 0.2\%$ and $u(\rho) = 5 \cdot 10^{-4}$ g.cm⁻³.