

## Supporting Information

### A Lattice Fluid Equation of State for Associating CO<sub>2</sub> + Polymer Systems

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Table S1: Experimental and calculated CO<sub>2</sub> solubility in PEG300

| Temperature<br>(K) | Pressure<br>(MPa) | Experimental Weight<br>Fractions | Calculated Weight<br>Fractions | % Error |
|--------------------|-------------------|----------------------------------|--------------------------------|---------|
| 303.15             | 0.148             | 0.0034                           | 0.0042                         | 23.90   |
| 303.15             | 0.279             | 0.0074                           | 0.0078                         | 5.15    |
| 303.15             | 0.424             | 0.0108                           | 0.0114                         | 5.75    |
| 303.15             | 0.663             | 0.0168                           | 0.0173                         | 3.07    |
| 303.15             | 0.804             | 0.0224                           | 0.0225                         | 0.49    |
| 303.15             | 1.066             | 0.0299                           | 0.0303                         | 1.33    |
| 313.15             | 0.157             | 0.0028                           | 0.0031                         | 9.50    |
| 313.15             | 0.279             | 0.0055                           | 0.0056                         | 1.00    |
| 313.15             | 0.419             | 0.0090                           | 0.0087                         | 2.54    |
| 313.15             | 0.586             | 0.0120                           | 0.0124                         | 3.27    |

Table S1 – Continued

| Temperature<br>(K) | Pressure<br>(MPa) | Experimental Weight<br>Fractions | Calculated Weight<br>Fractions | % Error |
|--------------------|-------------------|----------------------------------|--------------------------------|---------|
| 313.15             | 0.835             | 0.0181                           | 0.0177                         | 2.51    |
| 313.15             | 1.102             | 0.0247                           | 0.0252                         | 2.01    |
| 323.15             | 0.141             | 0.0023                           | 0.0023                         | 1.02    |
| 323.15             | 0.308             | 0.0048                           | 0.0049                         | 0.87    |
| 323.15             | 0.422             | 0.0077                           | 0.0077                         | 0.82    |
| 323.15             | 0.576             | 0.0105                           | 0.0104                         | 0.38    |
| 323.15             | 0.841             | 0.0149                           | 0.0136                         | 8.75    |
| 323.15             | 1.107             | 0.0212                           | 0.0212                         | 0.27    |
| 333.15             | 0.155             | 0.0023                           | 0.0021                         | 8.76    |
| 333.15             | 0.311             | 0.0047                           | 0.0049                         | 4.58    |
| 333.15             | 0.437             | 0.0071                           | 0.0068                         | 3.24    |
| 333.15             | 0.591             | 0.0094                           | 0.0091                         | 2.58    |
| 333.15             | 0.881             | 0.0150                           | 0.0141                         | 5.93    |
| 333.15             | 1.131             | 0.0190                           | 0.0190                         | 0.06    |
|                    |                   |                                  | % AAD                          | 4.07    |

Table S2: Experimental and calculated CO<sub>2</sub> solubility in PVAc

| Temperature<br>(K) | Pressure<br>(MPa) | Experimental Weight<br>Fractions | Calculated Weight<br>Fractions | % Error |
|--------------------|-------------------|----------------------------------|--------------------------------|---------|
| 313.15             | 0.199             | 0.005                            | 0.0055                         | 1.27    |
| 313.15             | 0.459             | 0.014                            | 0.0149                         | 3.21    |
| 313.15             | 0.858             | 0.027                            | 0.0267                         | 2.68    |
| 313.15             | 1.271             | 0.041                            | 0.0403                         | 1.75    |
| 313.15             | 1.949             | 0.064                            | 0.0645                         | 0.99    |
| 313.15             | 2.375             | 0.079                            | 0.0795                         | 1.20    |
| 313.15             | 2.818             | 0.094                            | 0.0952                         | 1.20    |
| 313.15             | 3.26              | 0.11                             | 0.1112                         | 1.13    |
| 313.15             | 3.589             | 0.122                            | 0.1236                         | 1.25    |
| 313.15             | 3.979             | 0.137                            | 0.1396                         | 2.24    |
| 313.15             | 4.449             | 0.155                            | 0.1579                         | 2.21    |
| 313.15             | 4.978             | 0.175                            | 0.1791                         | 2.16    |
| 313.15             | 5.407             | 0.193                            | 0.1967                         | 2.11    |
| 313.15             | 5.916             | 0.214                            | 0.2184                         | 1.80    |
| 313.15             | 6.375             | 0.234                            | 0.2387                         | 1.84    |
| 313.15             | 6.876             | 0.258                            | 0.2623                         | 1.74    |
| 333.15             | 2.263             | 0.053                            | 0.0506                         | 4.74    |
| 333.15             | 4.104             | 0.098                            | 0.0925                         | 5.52    |
| 333.15             | 6.01              | 0.146                            | 0.1459                         | 0.30    |

Table S2 – Continued

| Temperature<br>(K) | Pressure<br>(MPa) | Experimental Weight<br>Fractions | Calculated Weight<br>Fractions | % Error |
|--------------------|-------------------|----------------------------------|--------------------------------|---------|
| 333.15             | 7.772             | 0.193                            | 0.1924                         | 0.37    |
| 333.15             | 9.694             | 0.249                            | 0.2493                         | 0.08    |
| 353.15             | 2.211             | 0.038                            | 0.0342                         | 10.90   |
| 353.15             | 4.199             | 0.074                            | 0.0660                         | 10.51   |
| 353.15             | 6.11              | 0.109                            | 0.0994                         | 8.45    |
| 353.15             | 8.015             | 0.143                            | 0.1349                         | 5.86    |
| 353.15             | 9.876             | 0.176                            | 0.1765                         | 0.00    |
|                    |                   |                                  | % AAD                          | 2.90    |