

# Supplementary information: Rapid Microfluidic Screening of CO<sub>2</sub> Solubility and Diffusion in Pure and Mixed Solvents †

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## ternary mixture data

composition			$x(-)$	$D (10^{-9} \text{ m}^2/\text{s})$
IL	NMP	Depeg		
1.00	0.00	0.00	0.030	0.37
0.00	1.00	0.00	0.014	2.01
0.00	0.00	1.00	0.041	1.09
0.50	0.50	0.00	0.023	0.91
0.25	0.75	0.00	0.020	0.95
0.99	0.01	0.00	0.030	0.58
0.98	0.02	0.00	0.027	0.37
0.97	0.03	0.00	0.028	0.42
0.96	0.04	0.00	0.026	0.33
0.94	0.06	0.00	0.028	0.60
0.85	0.15	0.00	0.025	0.26
0.75	0.25	0.00	0.022	0.78
0.70	0.30	0.00	0.025	0.20
0.60	0.40	0.00	0.024	0.27
0.95	0.05	0.00	0.029	0.68
0.95	0.05	0.00	0.027	0.35
0.90	0.10	0.00	0.026	0.43
0.85	0.15	0.00	0.024	0.45
0.80	0.20	0.00	0.024	0.61
0.67	0.33	0.00	0.021	0.87
0.60	0.40	0.00	0.018	0.75
0.40	0.60	0.00	0.018	0.79

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composition			$x(-)$	$D (10^{-9} \text{ m}^2/\text{s})$
IL	NMP	Depeg		
0.30	0.70	0.00	0.017	0.84
0.20	0.80	0.00	0.017	1.59
0.10	0.90	0.00	0.014	1.31
0.00	0.10	0.90	0.032	1.13
0.00	0.20	0.80	0.028	1.04
0.00	0.30	0.70	0.029	1.13
0.00	0.40	0.60	0.028	1.08
0.00	0.50	0.50	0.026	1.09
0.00	0.60	0.40	0.024	1.19
0.00	0.70	0.30	0.022	1.34
0.00	0.80	0.20	0.019	1.84
0.00	0.90	0.10	0.018	1.55
0.90	0.00	0.10	0.028	0.36
0.80	0.00	0.20	0.027	0.54
0.70	0.00	0.30	0.026	0.30
0.60	0.00	0.40	0.027	0.28
0.50	0.00	0.50	0.023	0.59
0.40	0.00	0.60	0.024	0.73
0.30	0.00	0.70	0.025	0.77
0.20	0.00	0.80	0.028	0.76
0.10	0.00	0.90	0.029	0.86
0.10	0.10	0.80	0.034	0.53
0.20	0.10	0.70	0.030	0.72
0.10	0.20	0.70	0.029	0.79
0.30	0.10	0.60	0.028	0.33
0.20	0.20	0.60	0.025	1.07
0.10	0.30	0.60	0.024	1.37
0.40	0.10	0.50	0.026	0.47
0.30	0.20	0.50	0.020	1.14
0.20	0.30	0.50	0.020	0.70
0.10	0.40	0.50	0.024	0.98
0.10	0.50	0.40	0.019	0.79
0.10	0.60	0.30	0.018	1.19
0.10	0.70	0.20	0.022	1.01
0.20	0.40	0.40	0.022	1.02
0.20	0.50	0.30	0.022	1.07
0.20	0.60	0.20	0.021	0.97
0.20	0.70	0.10	0.018	1.33
0.30	0.30	0.40	0.023	0.80
0.30	0.40	0.30	0.023	0.80
0.30	0.50	0.20	0.019	0.77
0.30	0.60	0.10	0.019	0.87

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composition				
IL	NMP	Depeg	$x(-)$	$D (10^{-9} \text{ m}^2/\text{s})$
0.40	0.20	0.40	0.021	0.32
0.40	0.30	0.30	0.023	0.78
0.40	0.40	0.20	0.021	0.81
0.40	0.50	0.10	0.021	0.83
0.50	0.10	0.40	0.024	0.40
0.50	0.20	0.30	0.024	0.47
0.50	0.30	0.20	0.022	0.75
0.50	0.40	0.10	0.021	1.03
0.60	0.10	0.30	0.026	0.72
0.60	0.20	0.20	0.025	0.44
0.60	0.30	0.10	0.022	0.45
0.70	0.10	0.20	0.025	0.44
0.70	0.20	0.10	0.023	0.44
0.80	0.10	0.10	0.024	0.36

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### List of Symbols

$a$	gas-liquid interfacial area per unit liquid volume, $\text{m}^2/\text{m}^3$
$c$	concentration, $\text{mol}/\text{m}^3$
$d$	hydraulic diameter, m
$D$	liquid phase diffusivity, $\text{m}^2/\text{s}$
$h$	channel height, m
$k$	liquid-side mass transfer coefficient, m/s
$L$	length, m
$M$	molecular weight, kg/mol
$N$	amount, mol
$p$	pressure, Pa
$R$	gas constant, J/mol/K
$T$	temperature, K
$U$	bubble velocity, m/s
$V$	volume, $\text{m}^3$
$w$	channel width, m
$x$	mole fraction, mol/mol
$z$	position, m

### Greek letters

$\alpha$	pressure drop per unit length, Pa/m
$\rho$	density, $\text{kg}/\text{m}^3$

### Dimensionless groups

$C_1$	proportionality constant for caps area mass transfer, –
$C_2$	proportionality constant for film area mass transfer, –

$H$	Henry's constant, –
$\Gamma$	dimensionless liquid concentration ( $=c_L R T H / p_0$ ), –
$\epsilon_1$	parameter used in Eqs (3) and (4) ( $=\alpha U / p_0 k_L a$ ), –
$\epsilon_2$	parameter used in Eqs (3) and (4) ( $=V_{G0} H / V_L$ ), –
$\eta$	dimensionless position ( $=z k_L a / U$ ), –
$\Theta$	dimensionless gas volume ( $=1 - H(V_{G0} - V_G) / V_L$ ), –

#### Subscripts

0	initial
eq	equilibrium
G	gas
L	liquid
S	solvent
ref	reference
out	outlet

#### Movie Details

The included movie (separately available in the supplementary information) measures  $1200 \times 904$  pixels, where one pixel corresponds to a square of  $7.1 \times 7.1 \mu\text{m}$ . The movie was recorded at 50 frames per second and plays at 5 frames per second. Experimental conditions: solvent octanol, liquid flow rate  $1.1 \mu\text{L}/\text{min}$ , feed pressure 0.68 barg.