Phase equilibrium studies of impure CO_2 systems to underpin developments of CCS technologies

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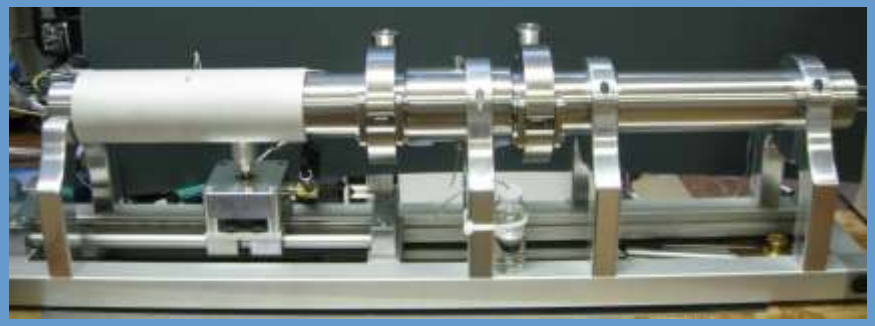
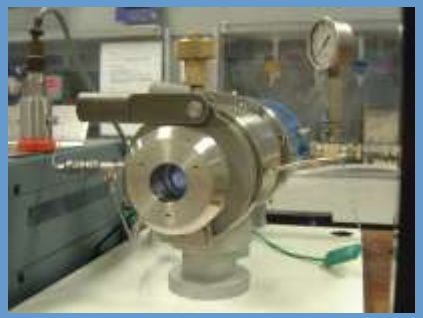
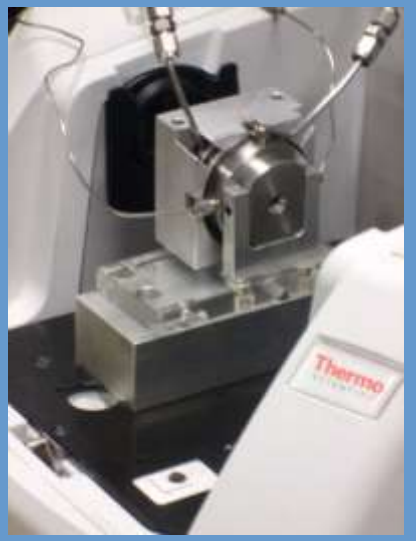
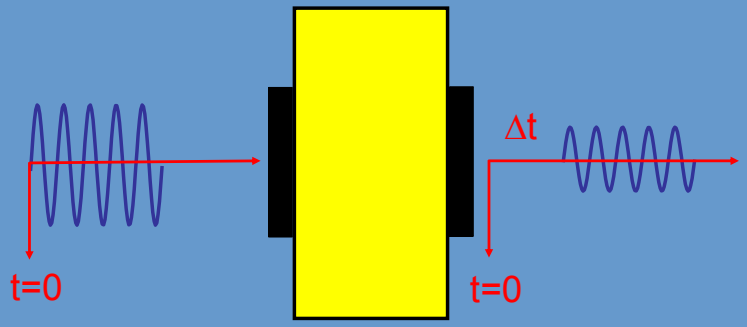


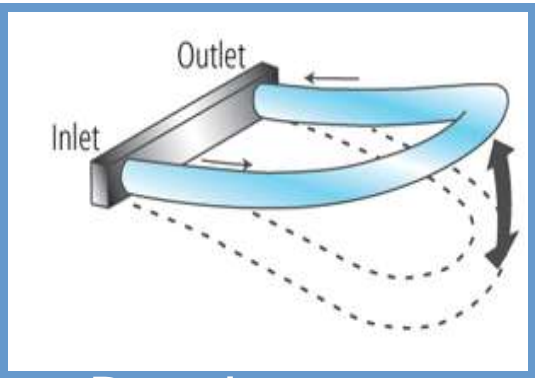




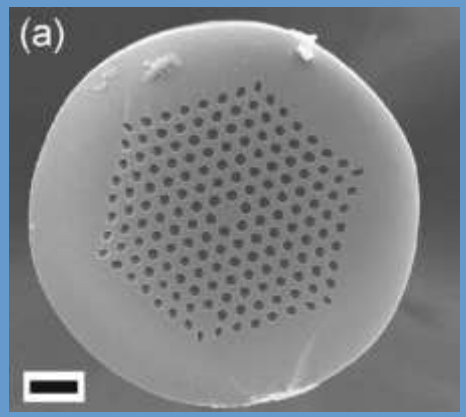
Sensors



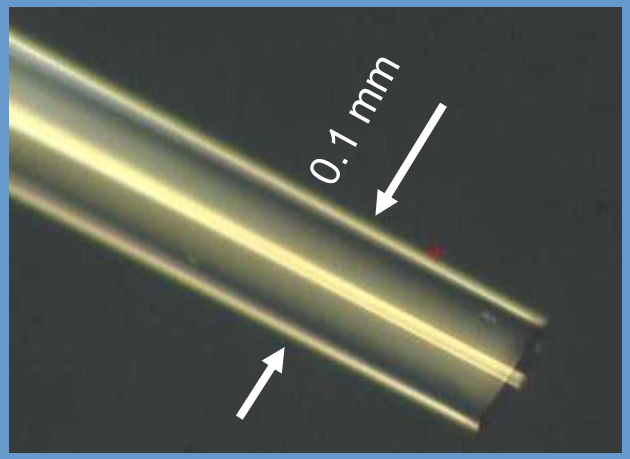
Sound Wave



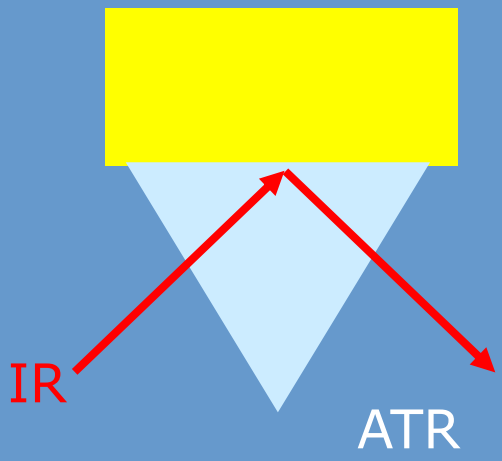
Density meter



Holey fibre + GC



Optical fibre



Shear-mode quartz

J. Phys. Chem. 1996, 100, 9522. *J. Phys. Chem.* 1997, 101, 5853. *Fluid Phase Equilib.* 1998, 150, 493. *J. Supercrit. Fluids* 2004, 30, 259. *Phys . Chem. Chem. Phys*. 2004, 6, 1258. *J. Chem. Eng. Data* 2009, 54, 1580.

Vapour-liquid-equilibrium and other thermodynamic properties of CO_2 mixtures

Density

$CO_2 + N_2$, $CO_2 + H_2$, $CO_2 + N_2 + H_2$ and $CO_2 + N_2 + Ar$

VLE

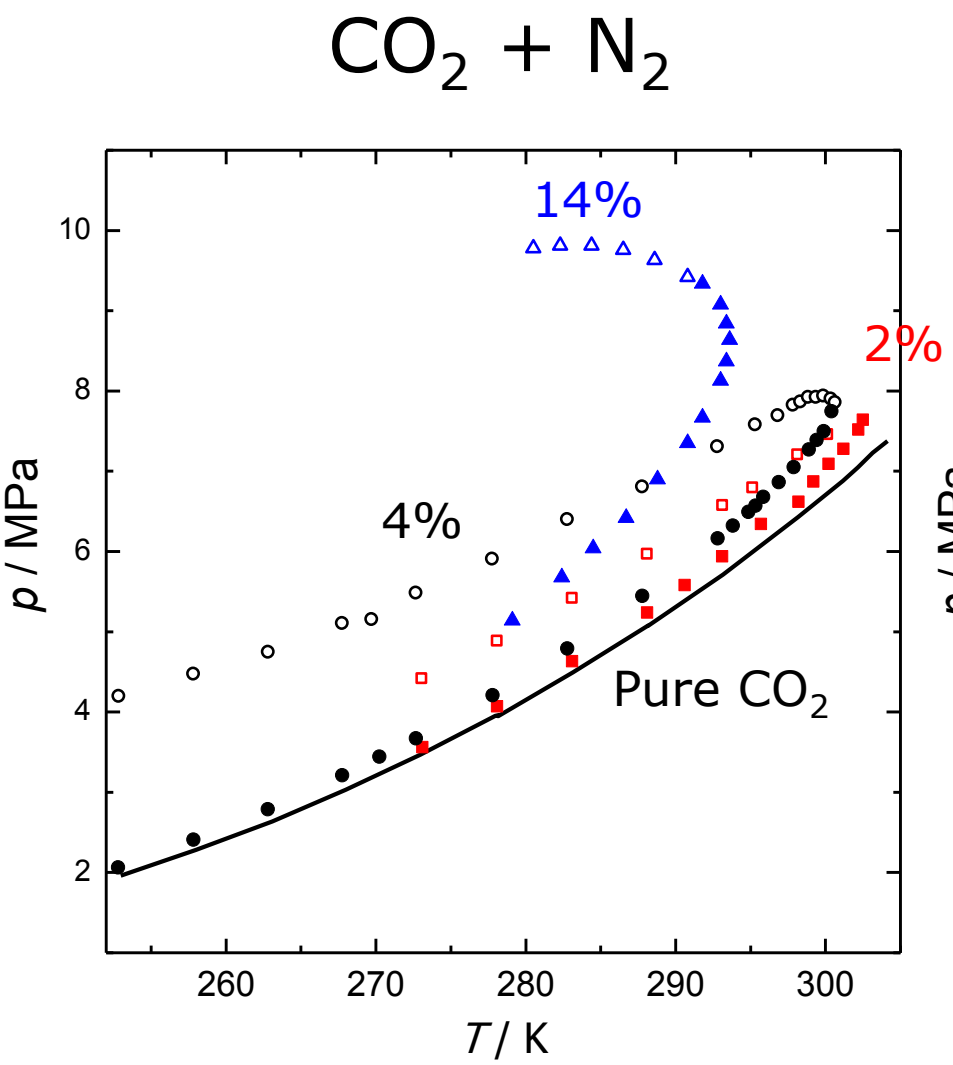
Without water

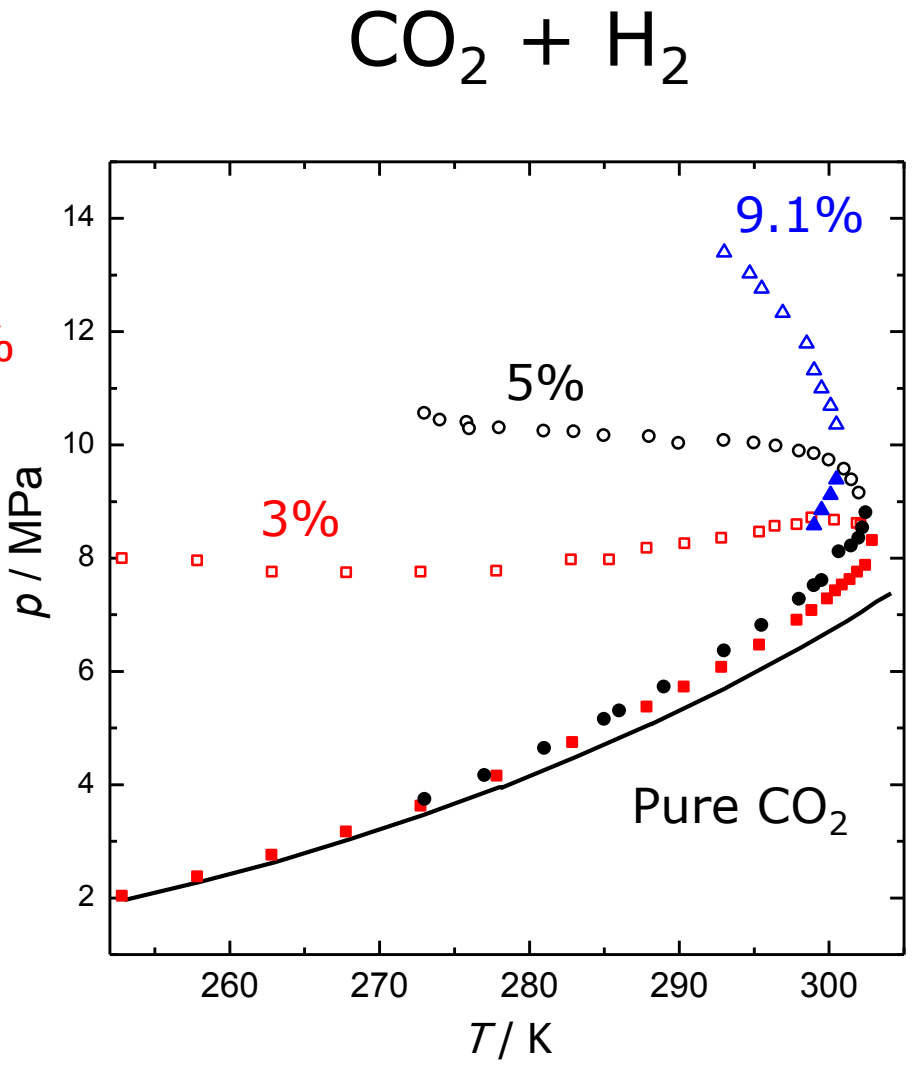
- $CO_2 + N_2$ (4 mixtures)
- $CO_2 + H_2$ (3 mixtures)
- $CO_2 + N_2 + H_2$ (2 mixtures)
- $CO_2 + N_2 + Ar$ (in progress, funded by ETI and PSE)
- $CO_2 + H_2 + Ar$ (in progress, funded by ETI and PSE)

With water

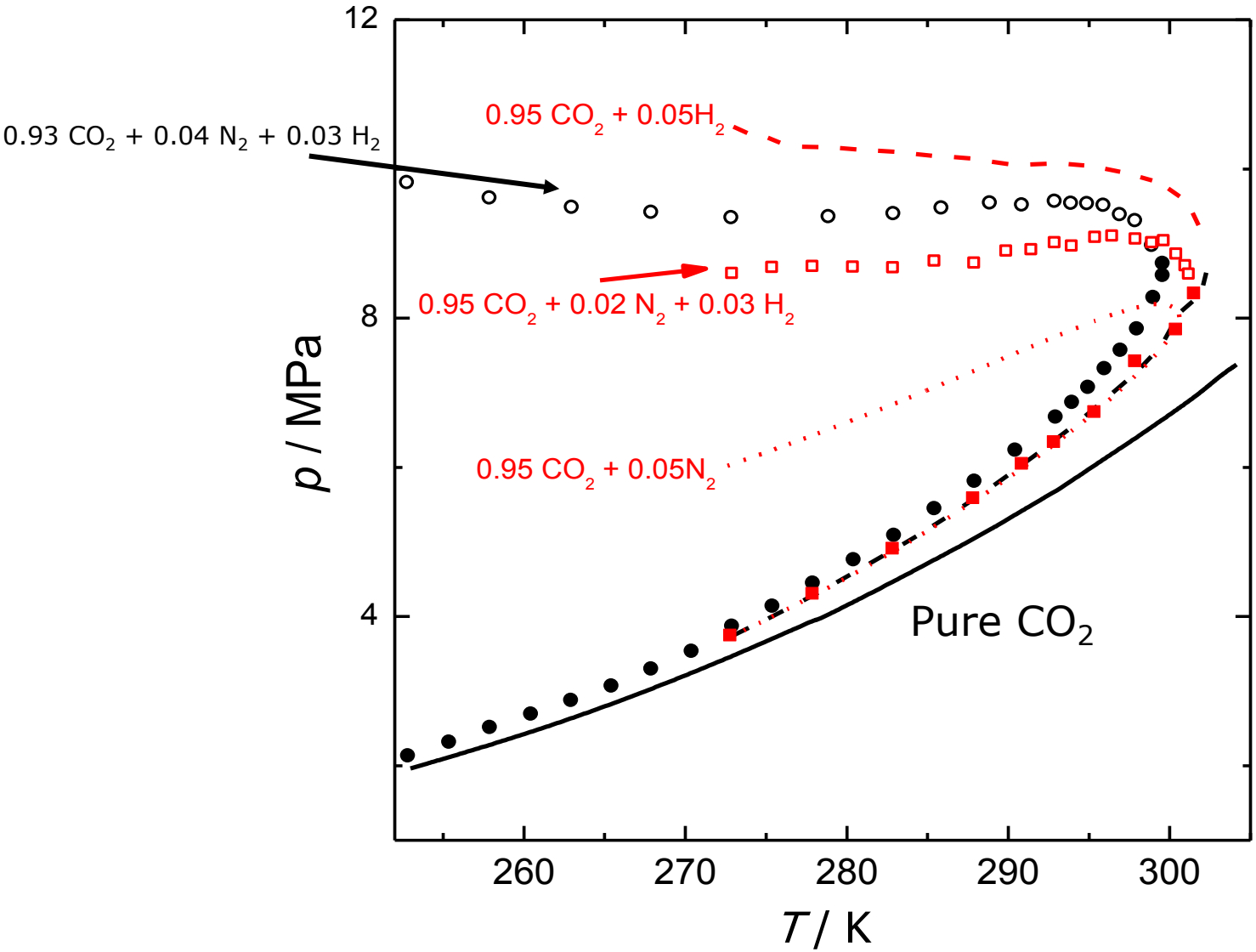
- $CO_2 + H_2O$
- $CO_2 + N_2 + H_2O$
- $CO_2 + H_2 + H_2O$

p – *T* phase boundary of CO_2 + N_2 and CO_2 + H_2

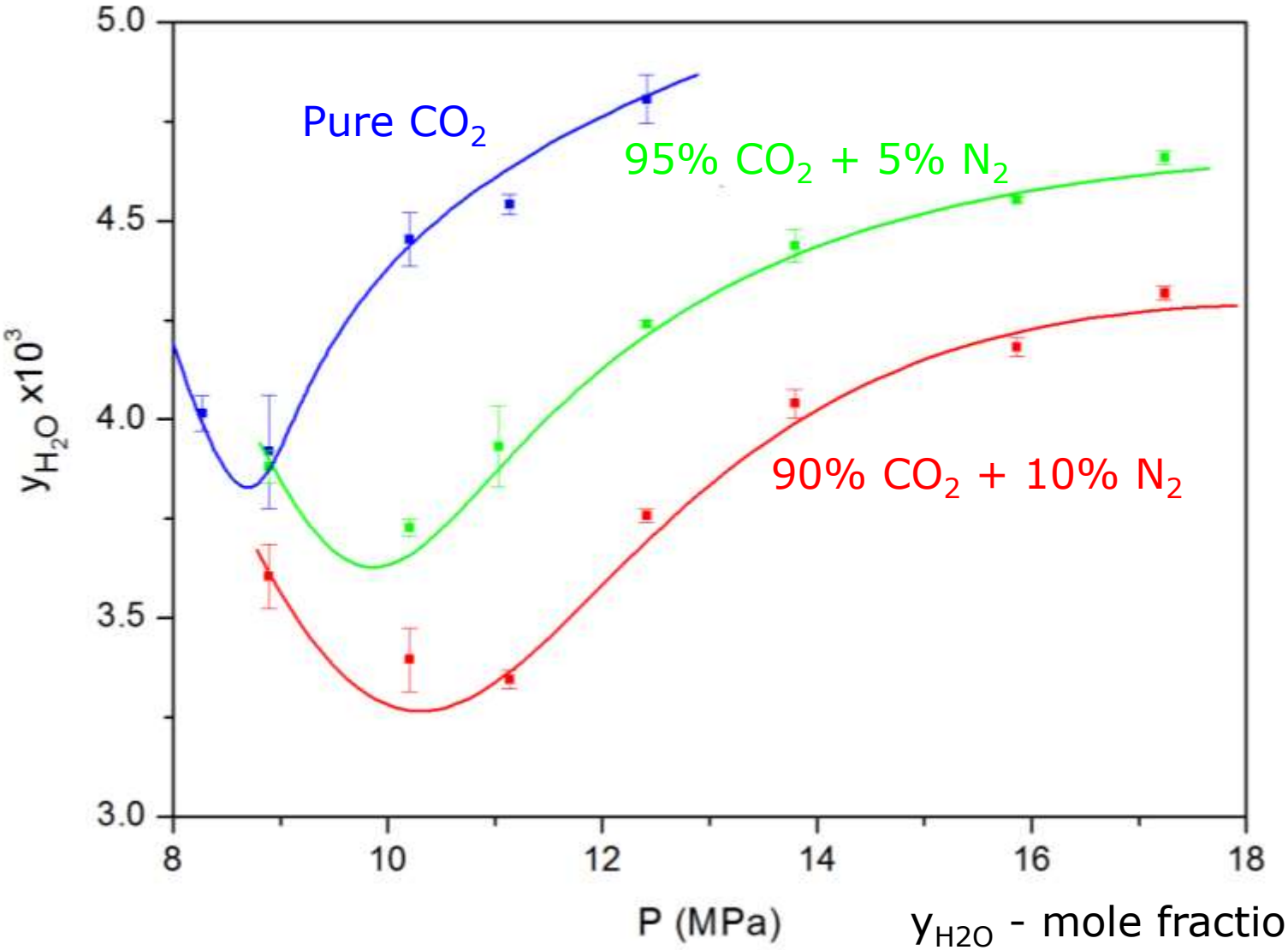




p – *T* phase boundary of the ternary system of $CO_2 + N_2 + H_2$



Solubility of H_2O in CO_2 + N_2 (40 °C)



y_{H2O} - mole fraction of H_2O

What is next?

- The VLE data of multicomponent mixtures (more than 5 components) of CO_2, N_2 and O_2, H_2, Ar, etc.
- The solubility of water in the mixture of CO_2 + N_2 + H_2.
- CO_2 and N_2 solubilities in sea water.

- **Karl-Fischer titration**
- **Spectroscopic methods**