

Magnetic Suspension Balance (MSB)

Motivation

- Magnetic Suspension Balance (MSB) is used to carry out kinetic and equilibrium measurements
- Vapour-liquid equilibrium measurements
- Solubility data (e.g., absorption or adsorption isotherms) can be examined gravimetrically with high accuracy

Experimental setup

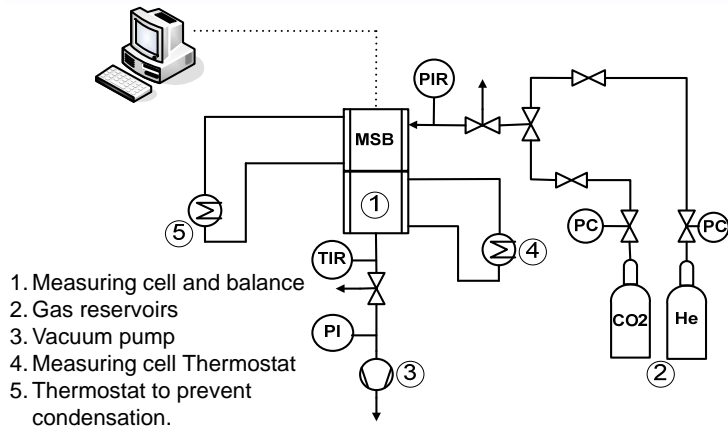


Fig. 1. Schematic flow chart

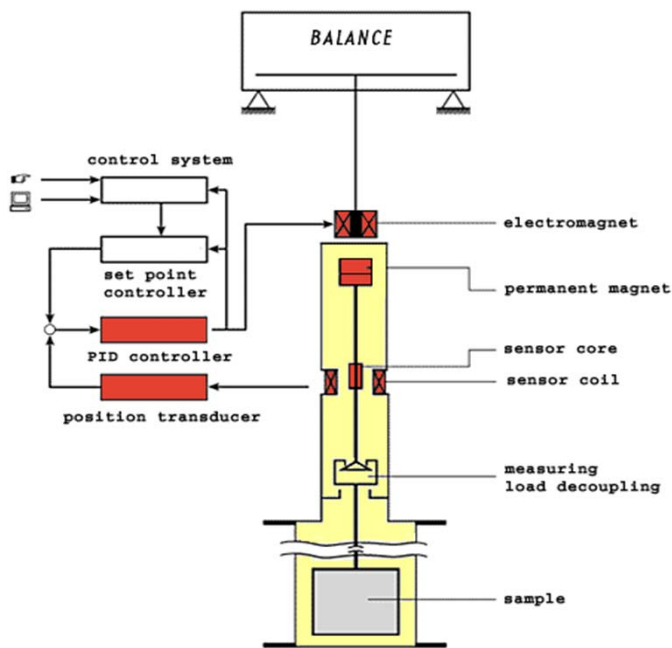


Fig. 2. Setup developed by Rubotherm

- Gravimetric measurements in a wide range of pressures and temperatures: 0...500 bar and 20...250°C
- Amount of sample: 0...25g
- Resolution: 0.01 mg and standard deviation: 0.02mg
- Buoyancy correction needed (from sample volume and density of the surrounding gas/vapour phase)

Data Reduction

- Determination of the sample volume by measurements for a non-absorbing gas (Helium).
- Measurement at constant temperature for a studied gas/vapour and calculating the mass of dissolved gas/vapour as follows:

$$M_{gas} = M(P, T) - M(P = 0, T) + \rho_{gas} \cdot (V_{basket} + V_{sample}(P, T, x_{gas}))$$

Notice: At high solubilities, the change of the sample volume should be taken into account.

Example

Alkane / alkene solubility in ionic liquids

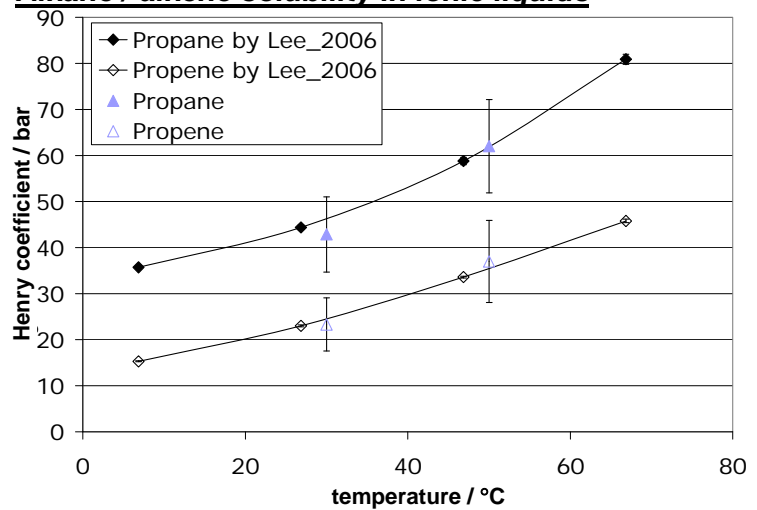


Fig. 3 Solubility of propane and propene in [BMIM][NTf₂]

→ good agreement with the literature data

Solubility of CO₂ in polymers

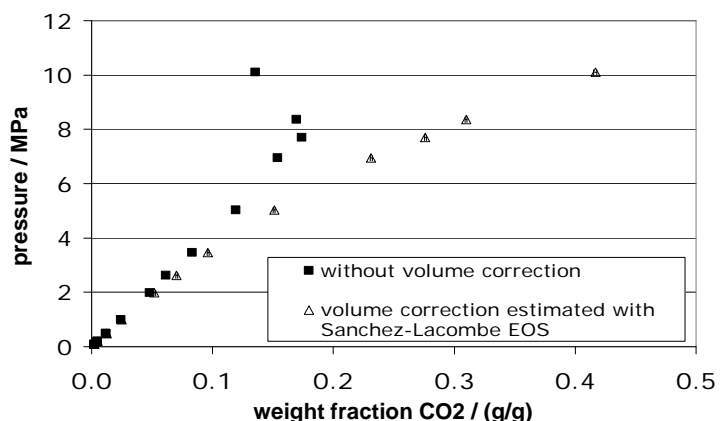


Fig. 4 Solubility of CO₂ in a hyperbranched polyether at 41°C

→ Volume correction is crucial at high solubilities

→ Estimation or external measurement is necessary as the volume increase cannot be measured directly with the MSB