Phase Diagrams and Physical Transformations of Substances

Thermo vs. kinetic

Diamond vs. graphite example
predictions spontaneity
does not predict rate
predictions the rate of reaction or process
connected to Gibbs energies and temperatures

\( \mu(g) < \mu(d) \)
diamond thermodynamically stable
graphite kinetically stable
metastable phases (e.g., diamond)

Terms and definitions
open vs. closed vessel
boiling/free vaporization
normal bp, 1 atm
standard bp, 1 bar
critical temp and pressure, \( T_c \) and \( p_c \)
supercritical fluid
triple point, \( T_3 \)

Pressure response
sample calculation

\( \mu_1 = \mu_2 \) at equilibrium

\( \frac{\partial \mu}{\partial T} \) at equilibrium

\( S_m(g) > S_m(l) > S_m(s) \)

Phase boundaries

Equilibrium

Phase stability and phase transitions

Slope of s/l boundary vs. s/g or l/g boundaries

Applied pressure and vapour pressure

proof of above equation

estimating effects of pressure (calc.)

sample calculation

\( p = p \cdot e^{\frac{\Delta H}{RT}} \)

\( \mu_1 = \mu_2 \) at equilibrium

\( \left( \frac{\partial \mu}{\partial T} \right)_p = -\frac{\Delta S_m}{T} \)

\( S_m(g) > S_m(l) > S_m(s) \)

Thermodynamic equilibrium

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Phase at given \( p, T \)

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