CERAMIC AND COLLOIDAL PROCESSING - EXERCISES

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Exercises 7

1. Calculate the surface tension of a liquid at temperature, T knowing its molar mass MM, its density ρ as well as the values of W_{AA} and z_b. Example: perform the calculation for CCl_4 (MM = 153.82 g/mole) at 25°C,
With, ρ = 1.6×103 [kg/m^3], W_{AA} = –1.78×10–20 [J/bond] and z_b = 6.

Note: Assume for simplicity that the CCl_4 molecules form a simple cubic structure in the liquid phase. (length of unit cell = side of cube = c= $((MM/\rho)/(N_A))^{1/3}$

2 Given the respective surface tensions of water and benzene (in air) are :

$$\gamma_{water} = 72.8 \text{ [mN / m]}, \gamma_{benzene} = 28.9 \text{ [mN / m]},$$

and the interfacial tension for the water / benzene interface is

$$\gamma_{water/benzene} = 35.0 \text{ [mN / m]},$$

calculate the initial water – benzene spreading coefficient.

After equilibration, a little benzene dissolves in the water which brings its surface tension to γ_{water} = 62.4 [mN / m]. What happens to the water-benzene spreading coefficient?

3. Capillary Rise
Determine the height h [cm] that a liquid rises in a capillary tube, knowing γ_{LV}, the surface tension of the liquid, ρ_L, the density of the liquid, r, the internal radius of the tube, and θ, the wetting angle of the tube wall by the liquid.

Example: the liquid is water (γeau = 72.8 [mN / m], MM = 18.02 [g / mole], ρ = 1'000 [kg / m^3]), the wetting angle θ = 20 °, and the radius of the capillary r = 0.10 [mm].

4. What is the Hamaker constant and its role in the attractive forces between 2 particles?