

# COSOM lecture INTERFACES

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**The states of matter** gas, liquid, solid, pair correlation function. Retrieve macroscopic properties from the model, such as why is a wet floor slippery? Which noble gas is the best choice for building a heat protection glass? Understand macroscopic properties as an average of the corresponding molecular quantities averaged about meso length scales. Understand isotropic and anisotropic properties, understand tensors, understand unusual phases: supercritical fluids, liquid crystals, nematic and smectic phases

**Condensed phases are the consequence of intermolecular forces** Can we liquefy an ideal gas? Discussion of ion-ion, ion -dipole, dipole-dipole, dipole induced dipole, induced dipole -induced dipole, H-bonding. Discussion of the potentials, relate the interaction energy to the thermal energy  $k_B T$

**Surface tension** Estimate the surface tension of a simple liquid from the pair interaction energy  $w_{AA}$ , Techniques for the determination of the surface tension: drop shape analysis, Wilhelmy system. Minimal surfaces and soap lamella, surface pressure, the escape mechanism of the Stenus, Langmuir Blodgett films

**Thermodynamics at interfaces** Repeat the key findings of phenomenological thermodynamics, the thermodynamic potentials, Maxwell relations, Boltzmann equation, Adsorption of soluble surfactants, Gibbs equation and excess, Laplace equation, Ion distribution at a charged interface, Poisson-Boltzmann equation.

**Adsorption** Adsorption, Langmuir equation, Brunauer-Emmett-Teller (BET) model, Frumkin-Fowler-Guggenheim model, Irreversible adsorption, Random Sequential Adsorption model

**Nucleation and growth** Undercooled liquids, Homogenous and heterogeneous nucleation, Ostwald ripening, Kelvins law, Understand phase separation by spinodal decomposition. How does the heat pad work? Understand the mechanism of clouding, Why is a rain cloud dark and a heap cloud white? Understand the experiment Menthos in Cola,

**Colloidal interactions** Van der Waals interactions. Electrical double layer forces DLVO Potential Stabilization of colloidal particle with end-adsorbed polymers in good solvent conditions. Molecular cooking: Lets look on some recipes, what is happening on a molecular scale? Link taste to the interfaces, novel cuisine parsley foam.

**Wetting, adhesion, friction and lubrication** Young's equation, work of adhesion and cohesion, Hamakers law, Contact angle advancing and receding, contact angle hysteresis, Lotus effect, Fundamentals of friction, Why can the gecko hang single toed on a vertical wall?

**Surface rheology** Nonequilibrium states, Surface dilational modulus, relation to foam stability, oscillating bubble technique