

# Introduction to Colloid Chemistry. Part I

## Winter Semester (2+2 SWS, 5 CP), Part of Modul 1

R. Buchner (lectures, Tuesday 10-12 h)

R. Neueder (calculus course, Thursday 10-12 h)

### Content

#### 1. Introduction

- What are colloids – types, specific features
- Preparation of colloidal dispersions
- Some examples (monodisperse sols, association colloids, emulsions, clay minerals, emulsion polymerization)

#### 2. Thermodynamics of Surfaces – A Brief Introduction

- Liquid mixtures – Hildebrandt model
- Interfacial energy
- Curved surfaces – Young-Laplace equation
- Adhesion and cohesion
- Capillary condensation
- Ostwald ripening and related phenomena

#### 3. Adsorption

- Adsorption isotherms for gases on solids (Langmuir, BET)
- Liquids on solids
- Gas-liquid interfaces – general considerations, Gibbs adsorption isotherm, monomolecular layers, Langmuir-Blodgett films,
- Visualization of monolayers on interfaces – a brief overview (computer simulation, scanning tunnel microscopy, atomic force microscopy, sum-frequency spectroscopy, ellipsometry)

#### 4. Interactions in Colloidal Systems

- Intermolecular forces – a short revision course
- Electrostatic multipole interactions
- Induced dipole moments
- Interactions of charged colloids with counter- and co-ions
- Forces between colloidal particles (forces between charged plates; dispersion interactions; DVLO theory; minor contributions: ion-ion correlations, surface dipoles, steric effects, solvent granularity, phase separation in capillaries, depletion forces)

## 5. Association Colloids

- Definitions revisited (see Section 1)
- Liquid mixtures revisited – Solvophobic interactions
- Packing parameter drives aggregate shape
- Models for micelle formation (isodesmic m.; phase-separation m.; closed-association m.)
- Methods for characterizing association colloids (aggregation number; kinetic processes; distribution coefficients)
- Effects of molecular structure, electrolytes and temperature on the critical micelle concentration
- Surfactant mixtures
- Some important micellar systems (fat digestion; domestic cleaners; catalysis in micellar systems)