

# Physical Chemistry of Surface

## Graduate 3 credit course in Polymer Engineering-Color curriculum

### Amirkabir University of Technology

**Chapter 1: Definition of surfaces and introduction to liquid and solid surface** (Surface tension and capillarity, Yang-Laplace equation, Kelvin equation and capillary condensation, crystal structure of solid surfaces, surface relaxation and rearrangements).

**Chapter 2: Thermodynamics of liquid/solid interface** (Definition of excess properties, thermodynamic definition of interface and Gibbs equation, Gibbs monolayer, determination of interface, surface energy and surface tension of liquids).

**Chapter 3: Thermodynamics of solid surface** (Surface tension and surface energy of solid interface and surface defects).

**Chapter 4: Definition of electric double layer** (Poisson-Boltzmann equation for diffuse layer, Graham equation and capacity of double layer, limitations of Poisson-Boltzmann theory, introduction to Stern layer, Gibbs free energy of double layer, electrocapilarity, examples of charged surfaces, surface charge density, zeta potential).

**Chapter 5: Surface forces** (Van der Waals forces, electric double layer forces, hydration and solvation forces, polymer steric forces, depletion forces).

**Chapter 6: - Adsorption and contact angle** (Introduction and definitions, adsorption thermodynamics, adsorption isotherms, experimental methods for adsorption measurements, contact angle principals, static and dynamic contact angle measurements, surface energy calculation).

**Chapter 7: Surface modification methods** (CVD/PVD method, macromolecular adsorption, etching, etc.).

**Chapter 8: Thin films on liquid surfaces and applications** (Micelles, emulsions and foams).

#### References:

1. H. Butt, K. Graf, M. Kappl. Physics and Chemistry of Interfaces, 3rd Edition. Wiley, 2013.
2. H. Butt, M. Kappl. Surface and Interfacial Forces, second Edition. Wiley, 2018.
3. H. Erbil. Surface Chemistry: Of solid and liquid interfaces. Wiley, 2006.
4. G. Kontogeorgis, S. Kiil, Introduction to Applied Colloid and Surface Chemistry, Wiley, 2016.