Basic Information:

Course Title: **THIN LIQUID FILMS – BIOMEDICAL APPLICATIONS**

Lecturer: Plamen Tchoukov, Ph.D., Assoc. Prof. and Ljubomir Nikolov, Ph.D., Assoc. Prof.
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Total Teaching Hours: 30 lecture hours

Annotation (up to 150 words)

The aim of the lecture course is to introduce the methods for formation of thin liquid films (foam, emulsion and wetting) and their study. Particular attention will be given to the experimentally measured parameters characterizing the film formation and stability, the transition from long to short range surface forces and bi and multilayer structures. Foam, emulsion and wetting films from amphiphile molecules: lipids and polymers (proteins and biocompatible molecules) and their mixtures as a model of the interactions at the interfaces (in biology, pharmacy and medicine) will be presented. The lecture course is suitable for PhD and post-doctoral students working in the fields of material science, physical chemistry, biophysics and biotechnology.

Course content (brief description by topics or modules)

Topic / Module 1: Thin Liquid Films (TLFs)

- Types of TLFs: foam, emulsion, and wetting films
- Common black films, Newton black films, and bilayers
- Surface forces and disjoining pressure isotherm
- Mechanisms of TLF rupture
- Microinterferometric method and cells for the preparation of thin liquid films
- Main parameters and measurable quantities of TLF
- Comparison of the TLF method with Atomic Force Microscopy (AFM) and the Surface Forces Apparatus (SFA)

Topic / Module 2: Thin Liquid Films as a Model of Biological and Biomedical Systems

- Lipid bilayers – model membranes
- Lipid bilayers in an electric field. Mechanisms of rupture
- Application of thin liquid films for the investigation of pulmonary surfactant and alveolar films
- Emulsions for drug delivery. Controlled release of active substances

Topic / Module 3: Demonstration / Laboratory exercise (3 hours)

Forms of Instruction and Assessment:

Lectures / Independent study (in case of an insufficient number of students); Practical exercise. Assessment – Individual assignment and final test.

Competencies acquired as a result of training (3–5 points)
Theoretical knowledge of the thermodynamics and hydrodynamics of TLFs; Basic knowledge of the structure of lipid bilayers; Mechanisms of bilayer rupture; Basic knowledge of representative biomedical applications.

Literature:
1. Sheludko, A. Thin liquid films. Adv. Colloid Interface Sci. 1967, 1, 391−464
2. Exerowa D., Krugliakov P. M. Foam and Foam Films – Theory, Experiment, Application (Mobius D., Miller R. eds.) Elsevier, Amsterdam, 1998
3. Lalchev Z. Phospholipid Foam Films: Types, Properties and Applications. in: Colloids and Interface Science Series, Vol. 1 (Tadros Th. ed.) Wiley-VCH, 2007

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