Department of Interfaces and Colloids

Institute of Physical Chemistry

Bulgarian Academy of Sciences

“Acad. G. Bonchev”Str., block 11

Sofia 1113, Bulgaria

Head: Elena Mileva

Long term research trend: (2010-2020)
DESIGN AND CHARACTERIZATION OF FUNCTIONALIZED INTERFACES AND SOFT NANOSTRUCTURED MATERIALS

Research groups:
Thin Liquid Films
Colloidal Electrooptics

- 2 professors
- 3 associate professors
- 6 post doctoral fellows
- 5 PhD students
- 2 researchers
- 1 MSc student
- 2 lab assistants

- 13 Chemists
- 5 Physicists
- 2 Biologists
- 1 Chemical Engineer
- 1 Mathematician

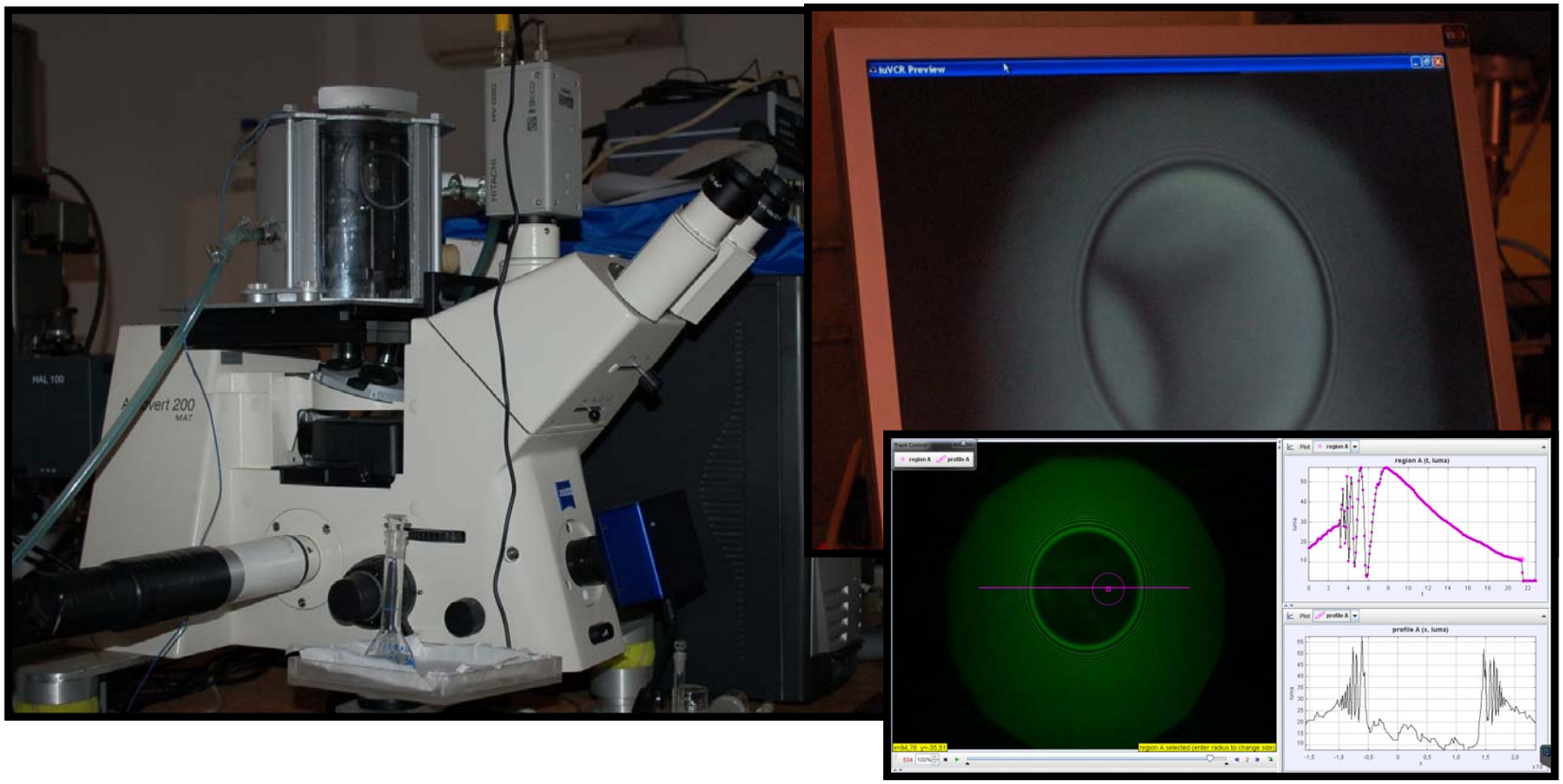
General research expertise:

- thin liquid films
- foams, emulsions and wetting phenomena
- electroptics of colloid dispersions
- design and investigation of various functionalized interfaces
- decorated micro- and nanoparticles
- studies of interaction, structure and dynamics of complex fluids and soft nanostructured materials

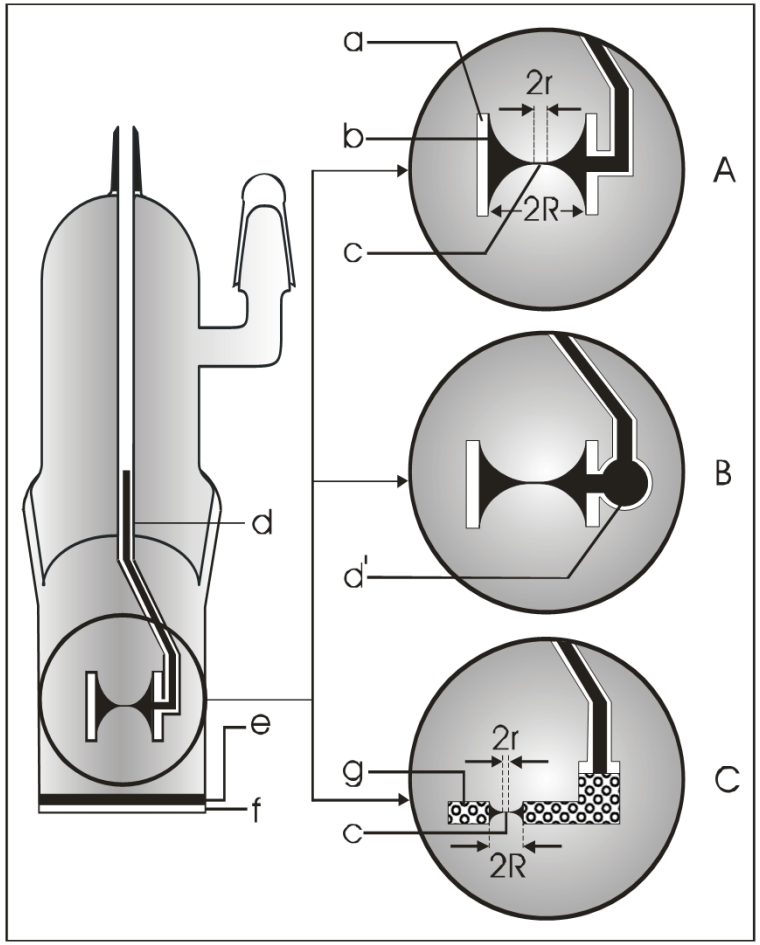
The specific topics recently investigated are:

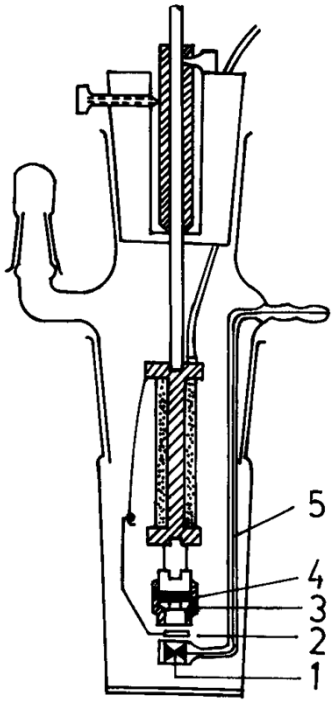
- ✓ Surface forces at fluid interfaces
- ✓ Foam stability studies
- ✓ Specific studies of amphiphilic bilayers as in vitro model of biological membranes
- ✓ Wetting films and three-phase contact investigation
- ✓ Electro-optics of colloid dispersions
- ✓ Design and characterization of functionalized interfaces

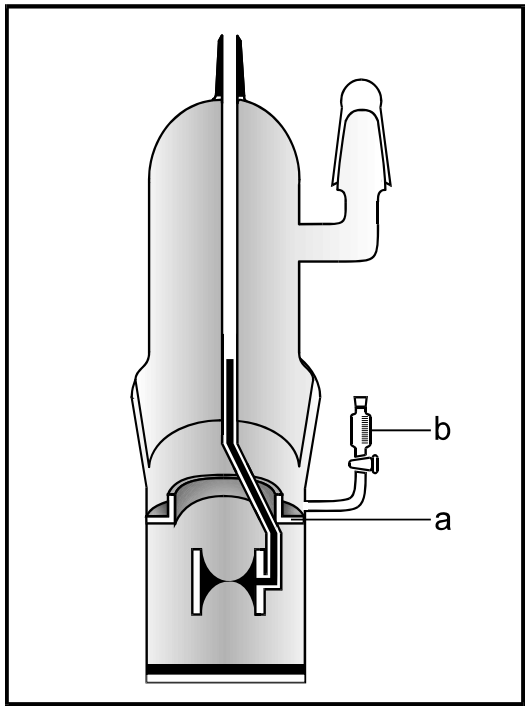
Specific research instrumentation



Specific research instrumentation

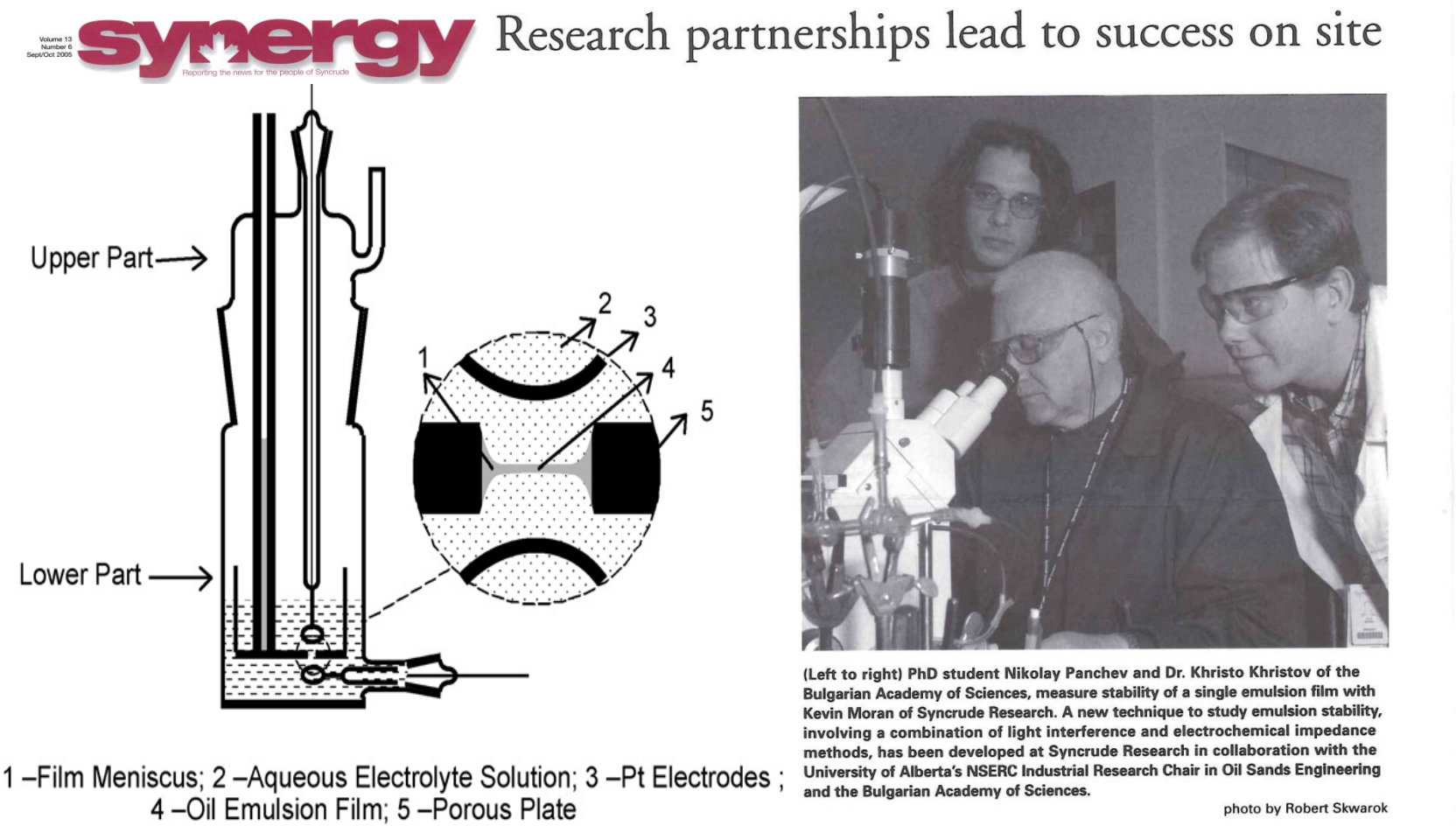






Specific research instrumentation

1 –Film Meniscus; 2 –Aqueous Electrolyte Solution; 3 –Pt Electrodes ; 4 –Oil Emulsion Film; 5 –Porous Plate



Volume 13 Number 6 Sept/Oct 2005

synergy

Reporting the news for the people of Syncrude

Research partnerships lead to success on site

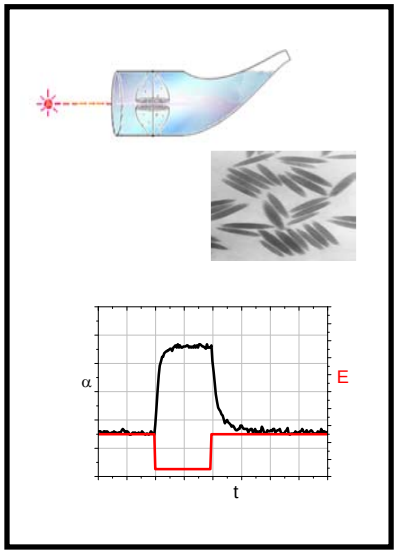
(Left to right) PhD student Nikolay Panchev and Dr. Khristo Khristov of the Bulgarian Academy of Sciences, measure stability of a single emulsion film with Kevin Moran of Syncrude Research. A new technique to study emulsion stability, involving a combination of light interference and electrochemical impedance methods, has been developed at Syncrude Research in collaboration with the University of Alberta's NSERC Industrial Research Chair in Oil Sands Engineering and the Bulgarian Academy of Sciences.

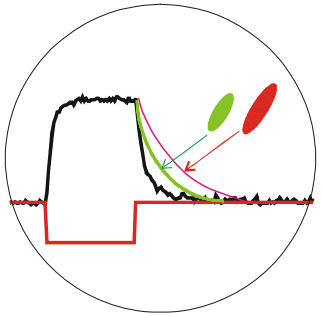
photo by Robert Skwarok

Specific research instrumentation

Home-made electrooptical device:

- ✓changes in the optical properties of disperse systems under the action of electric field
- ✓information about electric, optical and geometric parameters of colloid particles
- ✓determination of the mean diameters, estimation of polydispersity





Additional research instrumentation

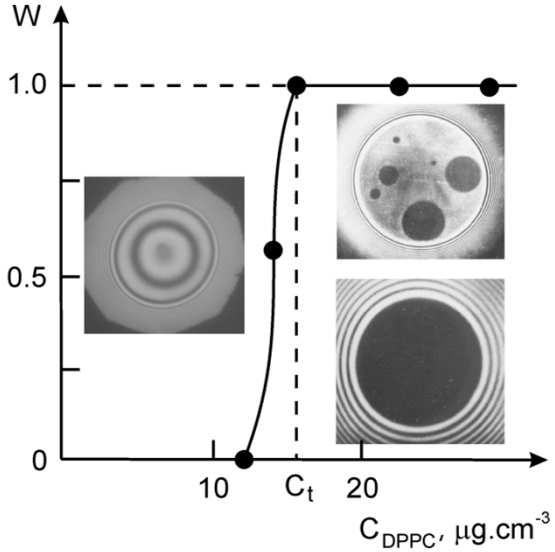
- ✓PAT-1 with double-dosing capillary and contact angle module
- ✓Langmuir through KSV NIMA with SPM
- ✓SEM (JEOL 6390) with EDS (Oxford Inca Energy 350)
- ✓Pyris Diamond TG/DTA
- ✓HRTEM
- ✓NMR

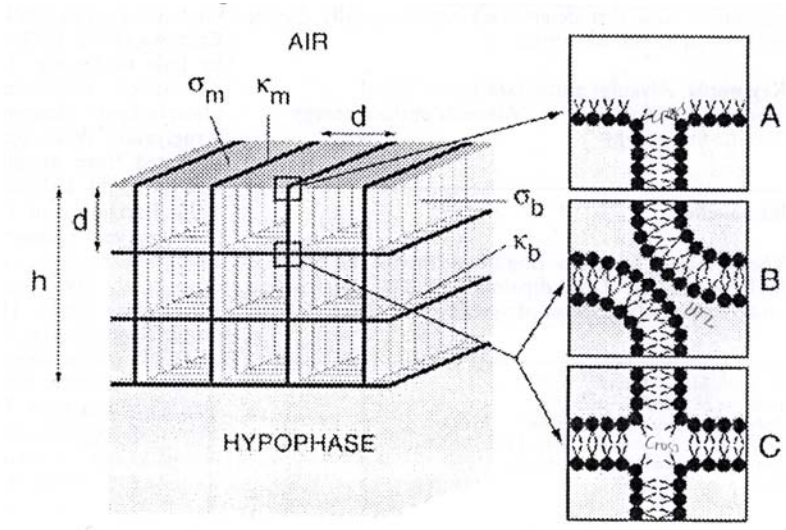
Research interests related to MP1106

- ✓Surface forces in wetting films, film tension and line tension of NBFs
- ✓Surfactants, phospholipids and proteins in solution, in thin liquid (foam, emulsion) films and on liquid interfaces
- ✓TLFs formed from natural surfactants - individual phospholipids and lung surfactant fractions, microbial surfactants: clarification of membrane–membrane interactions, cell fusion, lung-surfactant properties and structure
- ✓Role of Inhibitory factors (plasma proteins, lyso- and unsaturated phospholipids, free fatty acids) on the activity of pulmonary surfactant (PS) and TLSPs
- ✓Protein/surfactant formulations, application in food industry
- ✓HMW block, grafted and star-like copolymers, polymer/surfactant interactions, formulations for targeted drug delivery and diagnostics
- ✓Design of colloids decorated with multilayer coatings of synthetic and biopolymers with fine tuning of the thickness and electrical properties of the films and optical properties of the particles, application in drug delivery and water purification
- ✓Emulsifiers and demulsifiers, w/o emulsions, application in oil industry

Application potential of results related to MP1106

Based on the correlation between the probability of NBF-onset and the respiratory maturity of neonates, the microscopic foam film is used as an *in vitro* model for the study of alveolar surface and stability. NBF can be applied for the diagnostics of alveolar surfactant insufficiency (RDS) and for characterization and a targeted choice of therapeutic lung surfactants (e.g. Curosurf, Infrasurf, Survanta).



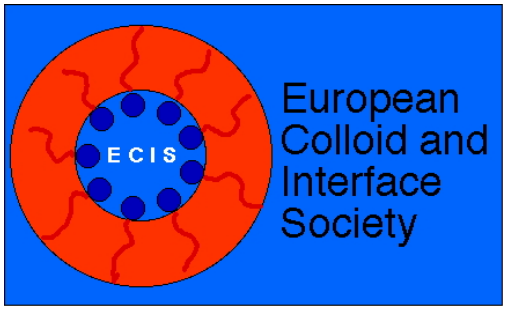


Some projects with industrial partners

Funding body	Project
Oil company “Syncrude”, Canada	Stability of bitumen emulsions
Food company “Orafti”, Belgium	Properties and stability of foam, emulsion and wetting films from solutions of Inulin-based surfactants
Pharmaceutical company “CHIESI”, Italy	Stability of Curosurf black films
Chemical company “Champion Technologies”, USA	Investigation of surfactants, applied as demulsifying agents in the oil industry
SME “Eco Aqua Pur”, Bulgaria	Demulsification formulations for petroleum sludges

Topics for future projects:

- ✓Impact of Nanoparticles (NPs) on the adsorption layer and bulk properties of complex biofluid systems
- ✓ Functionalized nanoparticles from biocopatible polymers for medical applications
- ✓Emulsifying and demulsifying formulations for foam and emulsion systems – oil production, food industry



27th ECIS Conference

1-6 September, 2013

Sofia, Bulgaria

Organizers:

Department of Interfaces and Colloids
Institute of Physical Chemistry
Bulgarian Academy of Sciences

Department of Physical Chemistry
Faculty of Chemistry
Sofia University

27th Conference of European Colloid and Interface Society

GOAL: The organizers warmly invite chemists, physicists, engineers to take part in interdisciplinary forum, where fundamental science and applied research will target topics in the fields of surface forces in dispersed systems, complex fluids, stability of thin films, engineered interfaces and smart nanostructured systems. The goal is to advance further theoretical and experimental achievements in the areas of biomedicine, nano-electronics, cosmetic, food and petroleum industries.

Topics

1. Surface Forces and Thin Liquid Films
2. Foams, Emulsions and Microemulsions
3. Surfactants, Lipids and Self-Assembly
4. Interfacial Electric Phenomena
5. Complex Fluids
6. Polymers, Gels and Phase Behaviour
7. Biocolloids/Interfaces in Pharmacy and Medicine
8. Micro- and Nanostructured Materials
9. Environmental Colloid Science

Place

Sofia is the capital of Bulgaria since 1879. The town dates back to the 7th century BC, when Thracians established their settlement next to an important and large mineral spring, still functioning today. It is located at the foot of Vitosha mountain. Sofia houses numerous museums: National History Museum, Natural Science Museum, Museum of Military History, Polytechnic Museum and Archeological Museum. The architecture of the city centre is a combination of Neo-Baroque, Neo-Rococo, Neo-Renaissance and Neo-Classicism, with Vienna Secession also playing an important role. Among the most important buildings are the former Royal Palace, today housing National Art Gallery and National Ethnographic Museum (1882); Ivan Vazov Theatre (1907); the former Royal Printing Office, today Gallery for Foreign Art; National Assembly of Bulgaria (1886); Bulgarian Academy of Sciences (1893); Sofia University (1934).

Organisers:
Department of Interfaces and Colloids
Institute of Physical Chemistry
Bulgarian Academy of Sciences
and
Department of Physical Chemistry
Faculty of Chemistry and Pharmacy
Sofia University

Chair: Elena Mileva
Co-Chair: Boryan Radoev
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Thank you for the attention!