

**Department of Amorphous Materials** - founded by Professor Ivan Gutzow, D.Sc.,

**Head: Dr. I. Avramov, e-mail: [avramov@ipchp.ipc.bas.bg](mailto:avramov@ipchp.ipc.bas.bg)**

Phase segregation in glass-forming systems: nucleation, crystallization and liquid-liquid phase separation. Relaxation of frozen-in systems, stabilization of glass. Thermodynamics and kinetics of glass transition and glass formation. Modeling and computer simulations of statistical mechanical systems. Static and dynamic properties of polymers and micelles. Equilibrium polymerization: living polymers and giant micelles.

**Research topics:**

- The disorder state of matter and its transitions
- Phase segregation in glass-forming systems: nucleation, crystallization and liquid-liquid phase separation
- Relaxation of frozen-in systems, stabilization of glass

**Department of Electrochemical Deposition and Metal Dissolution**

**Head: Dr. Ivan Krastev, Ph.D., e-mail: [krastev@ipchp.ipc.bas.bg](mailto:krastev@ipchp.ipc.bas.bg)**

Electrochemical investigations and development of new plating processes of metals and alloys. Investigations of the properties of electrodeposited metals and alloys. Investigations of self-organization phenomena during electrodeposition of silver alloys. New methods for testing the corrosion resistance of chromate films. Development of new anodic materials for hydroelectrometallurgy.



Spiral structures in Ag-Sb alloy coatings

**Research topics:**

- Electrochemical investigations and development of new plating processes of metals and alloys
- Investigations of the properties of different electrolytes
- Investigations of the properties of electrodeposited metals and alloys
- Investigations of electrode processes during electrodeposition and electrodisolution of metals and alloys
- Electrochemical measurements of the hydrogen permeation during electrodeposition on different metal substrates
- Investigations of self-organization phenomena during electrodeposition of silver alloys
- New methods for testing the corrosion resistance of chromate films

- Electrode processes in the electrowinning and electrorefining of zinc, copper and lead
- Development of new anodic materials for hydroelectrometallurgy

**Department of Electrochemically Obtained Materials and Corrosion Processes. Head: Senior Researcher Nikolay Atanassov, Ph.D., e-mail: [atanasso@ipchp.ipc.bas.bg](mailto:atanasso@ipchp.ipc.bas.bg)**

Electrodeposition of alloy coatings and examination of their properties. The relationship between plating parameters, structure and properties of electroless and electrodeposited alloys metals. Protective composite coatings based on epoxy and polyester resins including electronegative metals in highly dispersed state. Oxidized titanium anodes. Electrochemical processes, methods and technologies for electrolysis of water and water solutions. Production and electrochemical properties of various anodes.

**Research Groups:** Magnetic Films Group; Corrosion processes and corrosion protection group; New materials group

**Research topics:**

- Electrodeposition of alloy coatings and examination of their properties based on:
  - Ni (with Mn, W, Co, Fe);
  - Zn (with Co, Sn, Mn, Cr);
  - iron group metals with amorphous structure;
  - methods for chemical passivation (chromating) of Zn and Zn alloy coatings using environment-friendly compositions.
- The relationship between plating parameters, structure and properties of electroless and electrodeposited alloys and iron group metals.

**Department of Interface and Colloid Science, Head: Prof. Dotchi Exerowa, PhD, e-mail: [exerowa@ipchp.ipc.bas.bg](mailto:exerowa@ipchp.ipc.bas.bg)**

State of matter at interfaces and in thin liquid films. Electro-optics of Colloids.

**Research Groups:** Thin Liquid Films; Electro-optics of Colloids

**Research topics:**

State of matter at interfaces and in thin liquid films

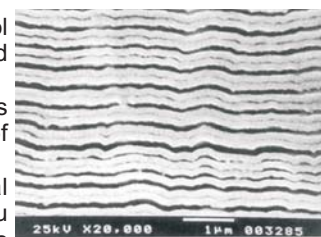
- Thin liquid films (foam, emulsion, wetting) - formation and stability.
- Thin liquid films as a model of colloid stability.
- Surface forces in thin liquid films - short-range and long-range interactions. Theoretical and experimental investigations of DLVO and non-DLVO forces.
- Amphiphilic bilayers of phospholipids and surfactants. Phase transitions in phospholipid bilayers.
- (Bio)polymers at solution/air interfaces - foam films of polymers: polymer/surfactant and phospholipid/surfactant interactions.
- New methods for characterization of electric surface parameters of gas liquid interface.

- Thermodynamics and kinetics of glass transition and glass formation
- Synthesis of amorphous, semi-crystalline and crystalline materials, glass ceramics and amorphous and semi-crystalline thin films
- Structural investigations of glasses using spectral methods and calorimetry
- Amorphous materials with nanosized metallic or semi-conducting microcrystals
- Modeling and computer simulations of statistical mechanical systems
- Static and dynamic properties of polymers and micelles
- Equilibrium polymerization: living polymers and giant micelles
- Theory of the glassy state solitons: misfit dislocations in thin epitaxial films



Waves of different phases of Ag-Sb alloy electrodeposits

- Magnetic behavior, mechanical properties (internal stress, hardness, stress relaxation) and thermal stability of thick and thin coatings.
- Protective-decorative and functional oxide layers on Al and its alloys.
- Protective composite coatings based on epoxy and polyester resins including electronegative metals in highly dispersed state.
- Investigation of the influence of composition and structure of low- and high-alloy steels on corrosion and anodic behavior in different aggressive media, etc. and at higher temperatures and pressures.
- Oxidized titanium anodes (including alloying of oxide layers with Ru, Ge, Ir, Mn).
- Automatic system for express control of metallic ions and other inorganic and organic water pollutions
- Electrochemical processes, methods and technologies for electrolysis of water and water solutions
- Production and electrochemical properties of various anodes (e.g. Cu alloy anodes, oxidized Ti alloy anodes etc.)



Scanning electron micrograph of the cross-section of a multilayer coating Cu/Ni-W (W 1 wt. %)

- Self-assembly in thin liquid films.
- Applications in biology and medicine - lung surfactant diagnostic methods (lung maturity test, therapeutic lung surfactant, etc.), biomembranes, biosurfactants and biomaterials.
- Applications in oil production, water pollution and treatment, food production, physicochemical characteristics of natural and synthetic surfactants and determination of their efficiency.
- Electro-optics of Colloids
- Surface electric properties of suspended particles.
- Colloid stability and processes of particle aggregation.
- Colloidal phase transitions and viscoelastic properties of disperse systems.
- Adsorption of ions, surfactants and polymers on colloid particles.
- Particle size determination.
- Applications in biology, medicine, ecology and (bio)technology.