

RUSSIAN ACADEMY OF SCIENCES

A.N. Frumkin Institute of Physical Chemistry and Electrochemistry
Arbuzov Institute of Organic and Physical Chemistry of FRC Kazan Scientific Center of RAS

XVIth INTERNATIONAL CONFERENCE SURFACE FORCES

August 20-25, 2018,
Kazan, Russia

Conference Programme and Book of Abstracts



ORGANIZATION

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CONFERENCE PROGRAM

Monday, August 20

Registration 16:00 – 19:00

Welcome party 18:00 – 19:30

Tuesday, August 21

9:10 – 9:25 Welcome and opening remarks

9:25 – 10:10 **K1. Todd M. Squires**, A. Banerjee, N. Shi, X. Tang, A. Bayles (USA).
Soluto-Inertial Interactions: Designing Long-Range, Chemically-Specific Interactions in Suspensions

10:10 – 10:35 **O1. Cathy E. McNamee**, H. Kawakami (Japan). **Reduction in the Inter-Surface Repulsive Forces between Two Charged Surfaces Containing Salts by the Presence of a Flow in the Liquid**

10:35 – 11:00 **O2. Pavel Dolganov** (Russia). **Interaction of Surfaces and Stability of Structures in Thin Smectic Free-Standing Films**

11:00-11:20 Coffee break

11:20 – 11:45 **O3. Marcelo Lozada-Cassou**, E. González-Tovar, A. González-Calderón (Mexico). **Very Long-Ranged Forces in Colloidal Dispersions at Finite Concentration**

11:45 – 12:10 **O4. Vitaly Svetovoy**, G. Palasantzas (Russia, The Netherlands). **Adhered Cantilever: A New Method to Measure Dispersion Forces between Rough Surfaces at Short Distances**

12:10 – 12:35 **O5. Kirill A. Emelyanenko**, L.B. Boinovich (Russia). **Effects of Spatial Confinement on the Dispersion Forces in Nanosized Alkane Films**

12:35 – 13:00 **O6. Kyosuke Ono** (Japan). **Disjoining Pressure and Diffusion Equation for Submonolayer Liquid Film**

13:00 – 14:00 Lunch

14:00 – 14:45 **K2. Drew Parsons** (Australia).
Electrode Surface Forces: Modelling and Specific Ion Effects

14:45 – 15:10 **O7. Anatoly Filippov**, T. Philippova (Russia). **Cell Model of Ion-Exchange Membrane: Electroconductivity and Electroosmotic Permeability**

15:10 – 15:35 **O8.** K.A. Komarov, E.V. Yakovlev, N.P. Kryuchkov, **Stanislav O. Yurchenko** (Russia). **Particle-Resolved Studies of Phase Transitions in 2D Colloidal Suspensions with Tunable Interactions in Rotating Electric Fields**

15:40 -16:00 Coffee break

16:00 – 17:40 **Poster Teasers Session**

17:40 – 19:00 **Poster session I.** The authors of posters with odd numbers are requested to be present at their posters during this session.

Wednesday, August 22

9:10 – 9:55 **K3.** M. Ludwig, S. Schön, **Regine von Klitzing** (Germany). **Surviving Ordering in Colloidal Suspensions Confined from 3D to 2D?**

9:55 – 10:20 **O9.** **Pavel Popovetskiy** (Russia)
The Structure of the Surface Layer of Silver Nanoparticles in Solutions of Nonionic Surfactants in Nonpolar Solvents

10:20 – 10:45 **O10.** **Dietmar Lerche**, L. Rodriguez, T. Sobisch, S. Süß, D. Segets, W. Peukert (Germany).
Profiling Particle Surface by Hansen Parameters to Predict Particle-Particle and Particle-Liquid Interaction

10:45 – 11:05 Coffee break

11:05 – 11:50 **K4.** **Patrick Kekicheff**, J. Iss, P. Fontaine, A. Johner (France).
The Long-Range Attraction between Hydrophobic Surfaces: Direct Measurement of Lateral Correlations under Controlled Nano-Confinement

11:50 – 12:15 **O11.** **Nikita M. Kuznetsov**, S.I. Belousov, D.Yu. Stolyarova, A.V. Bakirov, S.N. Chvalun, A.V. Shvidchenko, E.D. Eidelman, A.Ya. Vul' (Russia).
Detonation Nanodiamond Particles Organization in Hydrozols

12:15 – 12:40 **O12.** **Himanshu Mishra**, S. Pillai, B.R. Shrestha, A. Sanchez, D. Bapat, V. Dalvi, T. Pascal, S.H. Donaldson Jr. (Saudi Arabia, India, USA, France).
Hydrophobic Interactions Between Rigid Surfaces in Light and Heavy Water, Alcohols, and Various Electrolytes

12:40 – 13:05 **O13. Alexey G. Bykov**, G. Loglio, R. Miller, B.A. Noskov (Russia, Italy, Germany).
Aggregation of Charged Polystyrene Particles at Liquid Surfaces

13:00 – 14:00 Lunch

14:00 – 14:45 **K5. Jaroslaw Drelich** (USA).
Direct Measurements of Liquid Adhesion with Solids: Gateway to a Multi-Faceted Understanding of Contact Angles

14:45 – 15:10 **O14. Adya Karthikeyan**, E. Kasperek, P.-L. Girard-Lauriault, S. Coulombe, A.-M. Kietzig (Canada). **Tuning the Wettability of a Multi-Walled Carbon Nanotube Grown Stainless-Steel Mesh**

15:10 – 15:35 **O15. Alexandre M. Emelyanenko**, K.A. Emelyanenko, L.B. Boinovich (Russia). **Anisotropic Spreading Along the Textured Surfaces with Isotropic Wetting**

15:35 – 16:00 Coffee break

16:00 – 16:25 **O16. D.C. Malaspina and Jordi Faraudo** (Spain).
Wetting Behavior and Amphiphilic Character of Cellulose Nanocrystals from All-Atomic MD Simulations

16:25 – 16:50 **O17. Volfango Bertola** (United Kingdom) **The Origin of Contact Line Forces during Dewetting of Dilute Polymer Solutions**

16:50-17:15 **O18. B. Cross, C. Barraud, F. Restagno, L. Leger, Elisabeth Charlaix** (France) **Dynamic Flow of Confined Polyelectrolyte Solutions: Interfacial Friction and Complex Slip Length**

17:15 – 17:40 **O19. T.S. Dembelova, Dagzama N. Makarova, B.B. Badmaev, B.B. Damdinov** (Russia) **Shear Elasticity of Thin Layers of Colloid Suspensions of Nanoparticles**

17:40 – 18:00 **O20. Andrey V. Lyushnin** (Russia)
Solutocapillary Instability of Ultrathin Liquid Films

18:00 – 19:30 **Poster session II**. The authors of posters with even numbers are requested to be present at their posters during this session.

Thursday, August 23

- 9:10 – 9:55 **K6. Roger Horn** and S. Carnie (Australia).
Complex Behaviour of the Air-Water Interface.
- 9:55 – 10:20 **O21. Masashi Mizukami**, H.-Y. Ren, H. Furukawa, K. Kurihara (Japan)
Deformation of Contacting Interface between Polymer Hydrogel and Silica Sphere Studied by Resonance Shear Measurement
- 10:20 – 10:45 **O22. Olga Yu. Milyaeva**, A.G. Bykov, R. Miller, B.A. Noskov (Russia, Germany) **Influence of Lysozyme on Dynamic Surface Properties of Silica Nanoparticles Dispersions**
- 10:45 – 11:05 Coffee break**
- 11:05 – 11:50 **K7. Georg Papastavrou** (Germany).
New Colloidal Probes for Direct Force Measurements with the AFM.
- 11:50 – 12:15 **O23. Maria A. Kalinina**, A.I. Zvyagina, A.E. Baranchikov, A.R. Tameev, A.A. Ezhov, D.A. Grishanov, V.V. Arslanov (Russia).
Self-Assembly of Colloidal “Harlequins”: Monolayers of Graphene Oxide on Solids with Different Surface Energy
- 12:15 – 12:40 **O24. Boris Noskov**, S-Y. Lin, G. Loglio, R. Miller, O. Milyaeva, M. Krycki (Russia, Taiwan, Italy, Germany).
Dynamic Surface Properties of Protein/Surfactant Solutions

12:45 – 13:45 Lunch

14:00 – 19:00 Excursion to Sviyazhsk island

19:30 – 22:00 Conference Dinner

Friday, August 24

- 9:00 – 9:45 **K8. Lucia Zakharova** (Russia).
Self-Organization of Amphiphilic Compounds as a Powerful Tool for the Design of Smart Nanocontainers
- 9:45 – 10:10 **O25. Olga T. Kasaikina**, N.V. Potapova, D.A. Krugovov (Russia)
Formation and Properties of Reverse Mixed Micelles of Cationic Surfactants with Hydroperoxides

- 10:10 – 10:30 **O26. Natalia Selivanova, Y. Galyametdinov (Russia).**
Liotropic Liquid Crystals – Multifunctional Media for Molecular Electronics and Biomedicine
- 10:30 – 10:50 **O27. Sofia L. Selektor, A.V. Shokurov, D.S. Kudinova, A.G. Martynov, Yu.G. Gorbunova, V.V. Arslanov, A.Yu. Tsivadze (Russia)**
Surface Pressure Controlled Redox Isomerism in Monolayers and Langmuir-Blodgett Films of Crown-Substituted Bisphthalocyaninates of Lanthanides

10:50 – 11:10 Coffee break

- 11:10 – 11:35 **O28. N. Ryzhkov, Y. Lanchuk, A. Nikitina, N. Brezhneva, Ekaterina V. Skorb (Russia).** **Stability of Polyelectrolyte Assemblies to Photocatalytic Degradation**
- 11:35 – 11:55 **O29. Svetlana R. Derkach, N.G. Voron'ko (Russia).**
Self-Organization of Mixed Systems Containing Ionic Polysaccharide and Gelatin in the Bulk
- 11:55 – 12:20 **O30. Tatiana N. Pashirova, I.V. Zueva, K.A. Petrov, V.M. Babaev, E.A. Burilova, D.A. Samarkina, A. Braïki, L. Jean, P.-Y. Renard, E.B. Souto, P. Masson, L.Ya. Zakharova, O.G. Sinyashin (Russia, France, Portugal).** **Self-Assembly Strategy for Brain Protection and Treatment of Organophosphorus Poisoning Using Oximes-Loaded Lipid Nanoparticles**
- 12:20 – 12:40 **O31. Anton Muravev, E. Ivanova, A. Yakupov, F. Galieva, V. Semenov, M. Kadirov, S. Solovieva, I. Antipin (Russia).** **Aggregation Behavior of Heterocyclic Derivatives of (Thia)calix[4]arenes at the Air-Water Interface**
- 12:40 – 13:00 **O32. Ruslan R. Kashapov, A. Ziganshina, J.S. Razuvayeva, S.S. Lukashenko, L.Y. Zakharova (Russia).**
Supramolecular Amphiphilic Systems Based on Calix[4]resorcinols

13:00 – 14:00 Lunch

- 14:00 – 14:25 **O33. Alexander K. Shchekin, L.Ts. Adzhemyan, I.A. Babintsev (Russia).** **Kinetics of Micellar Aggregation: Molecular Mechanism versus Fusion-Fission Mechanism**
- 14:25 – 14:45 **O34. Maria G. Chernysheva, G.A. Badun, A.V. Shnitko, A.V. Sinolits, A.L. Ksenofontov (Russia).** **Lysozyme Adsorption Layers at Different Interfaces: Water-Air, Water-Xylene and Water-Diamond as Studied by Tritium Probe**

14:45 – 15:05 **O35. Vladimir Burilov**, R. Ibragimova, A. Valiyakhmetova, G. Fatikhova, D. Mironova, E., Sultanova S. Solovieva, I. Antipin (Russia). **New Calixarene Amphiphiles through “Click” Chemistry – Promising Self-Assemble Receptors**

15:05 – 15:25 **O36. Julia Morozova**, Ya. Shalaeva, A. Ermakova, V. Syakaev, I. Nizameev, M. Kadirov, A. Voloshina, V. Zobov, E. Kazakova, A. Konovalov (Russia). **Amphiphilic Resorcinarenes in the Construction of Supramolecular Systems in the Solution and at the Interfaces**

15:25 – 15:45 **O37. Guzaliia Fatykhova**, V.A. Burilov, D.A. Mironova, I.S. Antipin, S.E. Solovieva (Russia). **Receptors for Biomolecules Based on New Cationic and Anionic Calix[4]arene Amphiphiles**

15:45 – 16:00 Closing the Conference

CELL MODEL OF ION-EXCHANGE MEMBRANE: ELECTROCONDUCTIVITY AND ELECTROSMOTIC PERMEABILITY

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Electroosmotic permeability of ion-exchange membranes (IOM) is an important factor that significantly limits their use, for example, in fuel cells (FCs). Excessive water loss by such membranes leads to their overheating and possible destruction of the fuel cell itself. Therefore, for efficient operation of ion-exchange membranes in the FCs, it is necessary to know how their electroosmotic permeability will change when the moisture content and the background electrolyte concentration as well as the geometric and physicochemical characteristics of the ionite grains are varied. The existing theories for calculations of electroosmotic permeability do not fully answer the abovementioned questions. So, we decided to develop a closed cell model of an ion-exchange membrane, taking into account the transfer of water or another solvent in the hydrated/solvate ion shells. The cell model has shown its extreme efficiency in calculating the hydrodynamic permeability of complex porous membranes, thus, there are compelling reasons to apply it to the calculation of the electroosmotic permeability of heterogeneous membranes modeled as a set of charged porous particles of spherical or cylindrical shape [1].

Basing on the thermodynamics of non-equilibrium processes (the Onsager approach), we have set up and solved the boundary value problem for the Stokes, Brinkman, Nernst-Planck-Poisson system of equations governing the flow of a binary non-symmetric electrolyte through a liquid cell in the center of which there is a porous spherical particle, having a certain constant density of a fixed space charge (exchange capacity). At the boundary of the liquid shell, we used Kuwabara's (absence of vorticity) most adequate for electrokinetic phenomena condition, and at the interface between the porous particle and the electrolyte solution, we used conditions for the continuity of the velocity and the total stress tensor. Utilizing the cell approach developed by Happel and Brenner, the results of the BVP solution were applied to calculate the electroosmotic permeability of a charged membrane as a function of the fraction of the solid conducting phase (or moisture content), geometric and physicochemical characteristics of an ion-exchange grain and concentration of electrolyte.

The currently available formulas for calculating the electrical conductivity do not fully describe experimental results. In this connection, a cell approach was also applied to calculate the membrane conductivity. Our results are important in the study of ion-exchange membranes modified by inorganic nanotubes and nanoparticles, since in a number of practical importance cases there is an extreme dependence of the transport, mechanical and structural properties of hybrid nanocomposites on the content of dopant. Therefore, a systemic study of the electroosmotic permeability of a membrane coupled with its specific electric conductivity fulfilled in our research will make it possible to apply the cell approach to the characterization of membrane materials, and hence to the possibility of their correct choice and modification.

This study was supported by RFBR (project No.17-08-01287) and the Ministry of Education and Science of the Russian Federation (Grant No.14.Z50.31.0035).

[1] S. Vasin, A. Filippov, V. Starov, *Adv. Coll. Interface Sci.*, **139** (2008) 83.