ICREA Symposium "Nanofluidics, Colloids, and Membranes"

Barcelona, Catalonia, Spain, July16-18, 2012

In the scientific literature, the keyword "nano-fluidics" appeared for the first time in 1998. A massive publication record started in 2001, and since then ca. 1500 papers have been published that use this term. The goal of this ICREA Symposium is to integrate this burgeoning, interdisciplinary field of research with more mature scientific communities in colloid and membrane science, in order to catalyze new scientific advances and collaborations.

It is slowly becoming appreciated that many "nano-fluidic" phenomena were discovered and extensively studied earlier in colloid and membrane science, albeit motivated by different applications and without the benefit of current experimental capabilities. For example, electrokinetic and coagulation phenomena, which are central to colloid science, are controlled by body forces that act at distances of several nanometers from charged interfaces. Current-induced concentration-polarization (sometimes considered a "signature" of nano-fluidics as opposed to micro-fluidics) is well known in membrane science and is a physico-chemical basis of electrodialysis. The selective distribution and permeation of ions of different charges are basic phenomena in ion exchange and electrodialysis. A bipolar membrane is, in fact, a nanofluidic diode, and so on.

On the other hand, the field of nanofluidics has also demonstrated some new phenomena and applications, especially in non-equilibrium confined systems. For example, electro-osmotic flows have been used to drive chaotic fluid mixing in microfluidic devices, and propagating "shocks" of concentration polarization in nanochannels have been observed. Novel molecular-scale effects have also been demonstrated, e.g. related to particle transport in carbon nanotubes. Perhaps most importantly, the emergence of nanofluidics has opened the possibility of observing and controlling transport phenomena with unprecedented precision, down to the nanometer scale. As a result, classical theories of ion transport and surface interactions can now be systematically tested and improved.

The Symposium seeks to provide nanofluidic researchers with inspiration from colloid/membrane science, as well as keywords, author names, and references to the classical literature. Conversely, the Symposium will expose colloid and membrane scientists to recent advances in nanofluidics, in the hope of encouraging their contributions and showing new opportunities for experiments and applications of which they could only dream in years past. Thus, bringing together members of nanofluidic and colloid/membrane research communities will promote a very beneficial two-way information exchange. These are some examples of topics to be addressed..

- concentration polarization vs. space charge
- flow instabilities under non-linear conditions
- micro/nano interfaces
- applicability of quasi-macroscopic approaches at nano-scale

Roundtable discussions

- What is really new in nanofluidics?
- Brainstorming on applications of nanofluidics

Scientific Committee

M.Z.Bazant (MIT, USA) – co-chair
H.Bruus (Technical University of Denmark, Denmark)
J.Han (MIT, USA)
B.J.Kirby (Cornell University, USA)
A.Kornyshev (Imperial College London, UK)
N.Mishchuk (Institute of Colloid and Water Chemistry, Ukraine)
V.Nikonenko (Kuban State University, Russia)
J.Posner (University of Washington, USA)
I.Rubinstein (Ben-Gurion University of the Negev, Israel)
T.Squires (University of California at Santa Barbara, USA)
M.S.Strano (MIT, USA)
A.Yaroshchuk (ICREA and UPC, Spain) – chair
E.Zholkovksiy (Institute of Bio-Colloid Chemistry, Ukraine)

Organizing Committee

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M.Z.Bazant (MIT, USA) – co-chair, bazant@mit.edu
S.Casas (UPC) – secretary, sandra.casas@upc.edu

Venue

School of Industrial Engineering of Barcelona (ETSEIB), Polytechnic University of Catalonia (UPC), Barcelona, Catalonia, Spain

Dates

July 16-18, 2012

Registration fees

€300 - regular
€80 – student

The fees include participation at the symposium, conference materials, welcome reception, coffee breaks and lunches. These moderate fees are possible due to the generous financial support of ICREA[1].

*iCrea
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[1] ICREA = Catalan Institution for Research and Advanced Studies (www.icrea.cat)

Important dates

Abstract submission deadline: March 18, 2012

Abstract acceptance: April 20, 2012

Pre-registration deadline: May 15, 2012

Registration deadline: July 1, 2012

Important note

Due to the format of this meeting (no parallel sessions, ample time for discussions) the maximum number of participants will be limited by ca.100. Therefore, please pre-register (and later register) ASAP to secure your place

Web site

http://icreasymposium.eq.upc.edu/

Invited presentations

M.Z.Bazant (MIT, USA)
Desalination shocks in microstructures

H.Bruus (Technical University of Denmark)
Surface-charge dynamics in nanofluidic electrokinetics

J.Han (MIT, USA)
Pushing Ions Around: Applications of Ion Concentration Polarization

B.J.Kirby (Cornell University, USA)
Short- and long-term dynamics of the electrokinetics at hydrophobic surfaces

A.Kornyshev (Imperial College London, UK)
Colloids, interfaces, and liquid-liquid membranes for electro-variable nano-plasmonics

N.Mishchuk (Institute of Colloid and Water Chemistry, Ukraine)
Nonlinear electrokinetic phenomena and microfluidics

V.Nikonenko (Kuban State University, Russia)
Electrochemical methods of ion transfer characterization in ion-exchange membrane systems: theory and experiment

J.Posner (University of Washington, Seattle, USA)
Electrokinetic locomotion of bimetallic nano-rods

I.Rubinstein (Ben-Gurion University of the Negev, Israel)
Extended space charge and electro-osmotic instability in concentration polarization

T.Squires (University of California at Santa Barbara, USA)
Nonlinear electrokinetics and Faradaic reactions

M.S.Strano (MIT, USA)
Single molecule transport through nanopores created from high aspect ratio carbon nanotubes

A.Yaroshchuk (ICREA and UPC, Spain)
What makes a nano-channel? A limiting-current criterion

E.Zholkovksiy (Institute of Bio-Colloid Chemistry, Ukraine)
Hydrodynamic dispersion in micro- and nano-fluidics

Contacts

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