Micro- and Nano-Fluidics: Fundamentals and Applications

12 - 16 November 2018 @ Oort

The field of Micro/Nano-fluidics has offered useful toolboxes for a broad spectrum of disciplines, such as physics, chemistry, biomedical, as well as mechanical, chemical, and civil engineering. Our aim for the workshop was to bring together active researchers working on fundamental or application aspects of micro/nano-fluidics from different disciplines to discuss critical problems and advance new knowledge or technology for five crucial sub-fields, namely wetting, electrokinetics, nanofluidic transport, energy and environmental applications, and material/chemical/biomedical applications using micro/nanofluidics.

During the workshop, there were eleven keynote lectures sat the stage by giving brief reviews of the fundamentals, state-of-the-art research, and key open questions. In addition, for each of the five important topics, there were about three to five (junior and senior) researchers presenting their recent investigations and listing unresolved questions. All the presentations were of high-quality and hence brought lively discussion sessions, where we discussed essential directions and critical open questions and brainstormed possible solutions and approaches. We also had a couple of break-up sessions for researchers to efficiently establish (new) collaborations solving the problems.

In the discussion sessions, the roadmap for the sub-fields was discussed and listed. Several crucial open questions and future directions are identified and briefly summarized below. For instance, there is a strong need for experimental microfluidic instrumentations developed for quantitative physical or chemical measurements, e.g., zeta potential, diffusivity, solubility, nanoflow rates and velocities, as well as charges and surfactant concentrations at miniature interfaces. For the subfield of wetting, the key open questions include the (long-term) stability of droplet wetting and effects of surfactant upon superhydrophobic and super-slippery (liquid-impregnated) surfaces. With promising applications, non-equilibrium wetting under heat transfer and AC electrokinetics are also rarely explored. Slip length and appropriate hydrodynamic boundary conditions for complex fluids flowing over complex surfaces (such as polymeric or super-slippery surfaces) are crucial but have been studied to a less extent. The interactive and intense discussions have fostered several complementary collaborations; to name a few, simultaneously multiple accurate microfluidic measurements, phonon-induced electric effect, Taylor-Aris dispersion problem, as well as complex fluids in nano/micro-fluidics.

We are strongly enthusiastic about the interactions and future collective effort in advancing new directions and knowledge in the field via collaborative journal publications and research opportunities initiated by this workshop. Finally, we gratefully thank the Lorentz Centre and staff for the organization and support.

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