CPP 25: Wetting, Superamphiophobicity, Micro- and Nanofluidics II

Time: Tuesday 15:00–16:00 Location: ZEU 222

Invited Talk CPP 25.1 Tue 15:00 ZEU 222

Superhydrophobic Arrays of Functional Janus Micropillars — •Doris Vollmer, Periklis Papadopoulos, Lena Mammen, Clemens Weiss, and Hans-Juergen Butt — Max Planck Institute for Polymer Research

Wetting plays an important role in a wide variety of technological, biological, and environmental processes. Currently, a lot of research is devoted to control wetting via superhydrophilic or superhydrophobic surfaces. Combining these extreme wetting states opens exciting perspectives, including fabrication of superhydrophilic-superhydrophobic patterns to precisely control the flow and shape of liquids. High density microarrays can be fabricated using superhydrophobic Janus micropillars with a hydrophilic functional top surface. So far it was expected that the fabrication of superhydrophobic functional Janus micropillars would be conceptually impossible as the drop should immediately wet the substrate. We manifest that the fabrication of Janus micropillars is possible. Therefore, we demonstrate that the stability of the superhydrophobic state is determined by the rim of the pillars and argue that the stability of the composite state is given by a force and not by an energy balance as widely expected. The Janus pillars possess hydrophobic sidewalls and hydrophilic silica tops. The selective surface functionalization of the top surfaces with hydrophilic fluorescent molecules is illustrated with laser scanning confocal microscopy. Indeed the functionalization does not affect the stability of the air cushions.

CPP 25.2 Tue 15:30 ZEU 222

Mode Coupling of Phonons in a Dense One-Dimensional Microfluidic Crystal — •jean baptiste fleury[1], Ulf D Schiller[2], Shashi thutupalli[3], Gerhard Gompper[2], and Ralf Seemann[1,3] — [1]Saarland University, Saarbrücken, Germany — [2]Forschungszentrum Jülich, Jülich, Germany — [3]Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany

Long-living coupled transverse and longitudinal phonon modes are explored in dense and regular arrangements of flat microfluidic droplets. The collective oscillations are driven by hydrodynamic interactions between the confined droplets and can be excited in a controlled way. Experimental results are quantitatively compared to simulation results obtained by multi-particle collision dynamics. The observed transverse modes are acoustic phonons and can be described by a linearized far-field theory, whereas the longitudinal modes arise from a non-linear mode coupling due to the lateral variation of the flow field under confinement[1].

[1]Jean-Baptiste Fleury, Ulf D Schiller, Shashi Thutupalli, Gerhard Gompper and Ralf Seemann (Submitted) arXiv:1310.3655v1

CPP 25.3 Tue 15:45 ZEU 222

Semi-Flexible dense polymer brushes in flow - simulation & theory — •Frank Römer and Dmitry A. Fedosov — Theoretical Soft Matter and Biophysics, Institute of Complex Systems and Institute for Advanced Simulation, Forschungszentrum Jülich, Germany

The response of dense brushes of semi-flexible polymers to flow is of great interest in both technological and biological contexts. Examples include the glycocalyx on the endothelial surface layer in blood vessels [S. Weinbaum *et al.*, *Annu. Rev. Biomed. Eng.* **9**, 121–167, 2007] and mucus-like layers in lungs or the interior of nuclear pores. We employ smoothed dissipative particle dynamics (SDPD) [P. Español, M. Revenga, *Phys. Rev. E* **67**, 026705, 2003] simulations to study semi-flexible polymer brushes for a wide range of conditions including grafting density, polymer elasticity, and shear stress due to flow. Our simulation results are in good agreement with previous studies [Y.W. Kim *et al.*, *Macromolecules* **42**, 3650–3655, 2009], which focused on brushes with low grafting densities. We also propose a theoretical model which describes the deformation of dense semi-flexible polymer brushes in shear flow for a wide parameter range. The model allows us to predict effective deformation (height), inner density profile and hydrodynamic penetration depth (solvent velocity profile). Therefore, it is suitable to predict the effect of grafted surfaces on the flow profile in a slit or tube.