

Scientific report on the workshop

“Wetting and Capillarity in Complex Systems” (Dresden, 18 - 22 February 2013)

Aim and Focus: The workshop was organized in response to the growing interest in the interfacial properties of complex fluids (such as colloidal suspensions, organic ionic liquids, electrolytes, and liquid crystals) in contact with patterned or responsive substrates. This interest is nurtured by the potential to exert controlled manipulation of fluids at mesoscopic length scales. The underlying feature is that the hierarchical structure of patterned (responsive) substrates introduces a wealth of length and time scales which interplay with the intrinsic length and time scales of complex liquids. The complexity of such systems requires highly innovative approaches, which bundle experimental, theoretical, and computational skills. The goal of this international workshop was to achieve cross-fertilization between the various fields in Physics, Physical Chemistry, and Materials Science which deal with wetting and capillarity in experiment, theory, and simulations. This was facilitated by bringing together leading experts (36) and junior scientists (8) who delivered talks on various theoretical, experimental, or numerical topics, as well as a number of invited participants (10) and applicants presenting posters (17; three additional ones canceled their participation on short notice due to health or travel issues).

Most important participants: It is difficult to single out specific contributions because more than half of the participants are leading, senior experts in the field. All the talks have been of high scientific quality and the presentations included numerous open questions, which significantly facilitated discussions and interactions between the participants. The topics dealt with experimentally or theoretically (via analytical and numerical approaches) and presented in the talks included: static and dynamic Cassie-Wenzel transitions, liquid flow over uniformly textured substrates with inhomogeneous chemical composition, imaging and characterization of microscopic droplets condensing on patterned substrates, wetting of patterned substrates by ionic liquids, liquid crystals, or colloidal suspensions, electrowetting with ionic liquids, surface tensions of electrolytes, pair and multibody interactions between colloidal particles trapped at fluid-fluid interfaces, capillary induced clustering and self-assembly for colloids trapped at fluid-fluid interfaces, hydrodynamics of active gels, catalytically active droplets, wetting of hairy-elastic surfaces, Leidenfrost-levitated and propelled drops and solids, and wetting and spreading of liquid metals in the presence or absence of surface alloying. Among these presentations, one may eventually make a special note of the workshop Colloquium: “Wetting and drying of fibers”, a very insightful and thought provoking overview of the complex behavior resulting from the interplay between capillarity and elasticity given by Howard Stone, a renowned and leading expert of capillarity and wetting phenomena.

Newcomers: The talks and posters by the early career scientists (PhD students, postdocs, Assistant Professors) attending the workshop were of excellent quality and significantly added to the scientific content of the workshop. As an example one can mention the talks on the self-propulsion of chemically active drops by Y. Sumino (experiment) and N. Yoshinaga (experiment and theory), an emerging area that generated a lot of interest for the participants. It was very pleasing to see this sizeable group of young scientists taking part in the workshop, engaging in lively collegial discussions during the talks, the coffee breaks, the poster sessions, as well as during the free time, and establishing contacts for future collaborations or strengthening existing ones.

Scientific results in the broader sense: The response of the scientific community, and in particular from leading experts in the field, on the invitations to participate in this workshop was very enthusiastic, which led to vivid on-site discussions. These were facilitated by the balanced schedule of formal scientific presentation time and time for informal scientific discussions. The need for comprehensive collaborations between complex, powerful experimental techniques and intensive theoretical and numerical work in the studies of complex liquids in contact with complex substrates was strongly re-enforced by the workshop participants. This, together with the identification of new, emerging topics of significant academic and industrial interest (for example, self-assembly and dynamics enabled by interactions with (in) complex fluids) is expected to lead to a long lasting impact of this meeting.