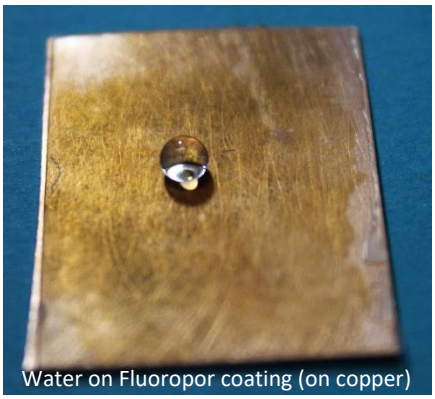
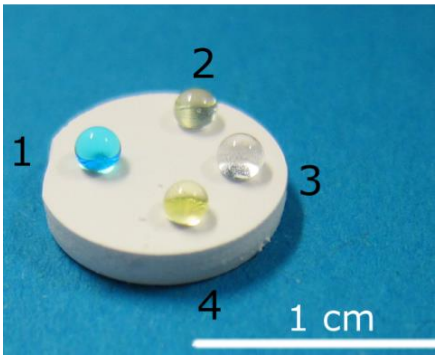
PhD Thesis, code: Fluoropor1

Development of novel super-omniphobic polymer surfaces

Stable, super-repellent surfaces are of high interest in industrial applications. They can prevent surfaces from fogging or icing, they can enhance the self-cleaning properties or reduce friction, e.g. by coating ship hulls. To achieve super-repellency on a solid surface, suitable surface chemistry (low surface free energy) must be combined with a surface structure, e.g. a roughness. We have recently introduced polymer foaming as a method to provide an inherent roughness that is insensitive to abrasion effects. This way we have developed Fluoropor, an optically transparent, superhydrophobic fluoropolymer foam that retains its repellency upon abrasion. This thesis aims at developing Fluoropor Surfaces with enhanced wetting properties, i.e. oil repellency. In the course of this work, you will


Water on Fluoropor coating (on copper)



1: water, 2: diiodomethane, 3: DMSO, 4: DMF on Fluoropor

- synthesize and test novel (fluorinated) monomers for polymerization of novel Fluoropor types
- establish novel techniques for Fluoropor foaming, e.g. introduction of a second polymerisation phase, introducing particles, discovering novel mixtures for generating high-internal phase emulsions (HIPE)
- establish novel techniques for creating organic gels or polymer brushes that provide a stable slippery effect on the surface – as known from SLIPS (slippery liquid infused porous surface)
- generate coatings of the novel materials on technical substrates (glass, metals, polymers)
- test the properties of the novel coatings, e.g. anti.fouling properties, friction on ship-hulls, anti-icing and coordinate the tests in cooperation with other institutions (industry and academia)

Requirements

Professional skills: studies in chemistry or materials science, well-grounded knowledge of chemical lab work (synthesis and analysis), knowledge of polymer chemistry and surface analysis.
Personal skills: You are interested in pursuing your own ideas and expanding your knowledge by extensive reading. You enjoy application-oriented science, scientific discussions and you are eager to present and publish your results.

For further information please contact:
Dr. Dorothea Helmer
Dorothea.Helmer@imtek.uni-freiburg.de
www.neptunlab.org
Lehrstuhl für Prozesstechnik
Institut für Mikrosystemtechnik
Georges-Köhler-Allee 103
Albert-Ludwigs-Universität Freiburg