Generation of micro-droplet arrays by dip-coating of biphilic surfaces; the dependence of entrained droplet volume on withdrawal velocity

Droplet array chips were realized using an alignment-free fabrication process in silicon. The chips were textured with a homogeneous nano-scale surface roughness but were partially covered with a self-assembled monolayer of perfluorodecyltrichlorosilane (FDTS), resulting in a super-biphilic surface. When submerged in water and withdrawn again, microliter sized droplets are formed due to pinning of water on the hydrophilic spots. The entrained droplet volumes were investigated under variation of spot size and withdrawal velocity. Two regimes of droplet formation were revealed: at low speeds, the droplet volume achieved finite values even for vanishing speeds, while at higher speeds the volume was governed by fluid inertia. A simple 2D boundary layer model describes the behavior at high speeds well. Entrained droplet volume could be altered, post-fabrication, by more than a factor of 15, which opens up for more applications of the dip-coating technique due to the significant increase in versatility of the micro-droplet array platform.
Projects:

**Biomineralization and Biomimetics**

Department of Micro- and Nanotechnology  
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