Droplet microfluidics

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Digital microfluidics is a technology based upon micromanipulation of discrete droplets. I will provide in my talk an overview on several digital microfluidics approaches based on μL to pL droplets without confining walls. Raster-scan synchrotron radiation scattering and spectroscopy techniques allow probing solution droplets and their evolution upon evaporation or coalescence with spatial resolution down to the sub-micron scale. Indeed, drop-on-demand inkjet systems can be used for probing pL-volume ballistic droplets without substrate interactions but only for a few milliseconds. The high droplet impact definition also allows initiating local hydration and reaction processes in micron-sized biopolymer fibers. The development of artificial superhydrophobic substrates mimicking the Lotus effect provides quasi contact-free conditions for probing droplets during evaporation and coalescence.[1] The wetting transition allows probing coffee-ring type residues which are also observed on wetting substrates. I will provide an overview on recent developments in probing colloidal self-assembly processes based on short peptides, gold glyconanoparticles and rod-like virus nanoparticles. The experiments were performed at the ESRF ID13 (SAXS/WAXS) and ID21 (FTIR) beamlines.

1. Accardo, A.; Fabrizio, E. D.; Limongi, T.; Marinaro, G.; Riekel, C., Probing Droplets on Superhydrophobic Surfaces by Synchrotron Radiation Scattering Techniques. *J. Synchr. Rad.* **2014,** *21*, 643-653