Master internship at laboratories Surface du Verre et Interfaces and Physique des Solides

Influence of the self-organization of surfactants on the drying of aqueous coatings

Context. Wet coating constitutes a key technique to the glazing industry for functionalizing large glass panels in an efficient and rapid way with layers that bring new optical, chemical, thermal and mechanical properties. These layers are very often complex fluids such as suspensions (paints, inks, etc.) that may comprise surface active species such as surfactants for particle stabilization. However, surfactants adsorb at the water/air and substrate/water interfaces as well. Depending on the surfactant's chemistry and dynamics, and also the drying conditions (relative humidity, temperature), the wetting behavior of the film and the ensuing final dry state can be impacted. So understanding how surfactant solutions behave under different physico-chemical conditions may represent a key challenge to both predict the stability of the deposited layers while drying and control the wetting or dewetting behavior for layer patterning.

At Surface du Verre et Interfaces, we have seen that model surfactant solutions can show very different drying behaviors, and they can either stabilize (Fig. 1) or destabilize a coating (Fig. 2). Moreover, some surfactants used can self-assemble into liquid crystal phases as water evaporates, and the specific structures formed seem to be important in the drying process. These phenomena have remained largely unexplored.

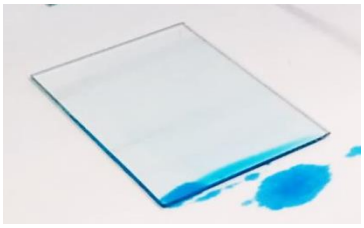

Figure 1: Wetting surfactant solution.

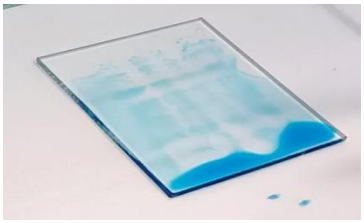

Figure 2: Dewetting surfactant solution.

Aim. The internship will focus on the influence of the bulk assembly structure of surfactants on the drying behavior of the wet coatings deposited on various solid substrates. We choose systems, where depending on the surfactant concentration during the drying stage, different liquid crystal phases can form such as nematic, lamellar or columnar phases. To perform the research, a large range of characterization techniques will be employed including Small-Angle X-ray Scattering (SAXS), bulk and surface rheology, the pending drop method, and polarized light microscopy.

Candidate's profile: Experimentalist with a broad condensed-matter physico-chemistry background and a strong taste for team work. The student will benefit from both academic and industrial environments as the internship will take place between the Laboratoire de Physique des Solides in Orsay and the Saint-Gobain/CNRS joint unit Surface du Verre et Interfaces, the latter lab being located within Saint-Gobain Research Paris, one of the largest transverse R&D centers of the group.

Applications including a CV and cover letter must be sent to:
Anniina Salonen: anniina.salonen@universite-paris-saclay.fr
Frédéric Mondiot: Frederic.Mondiot@saint-gobain.com