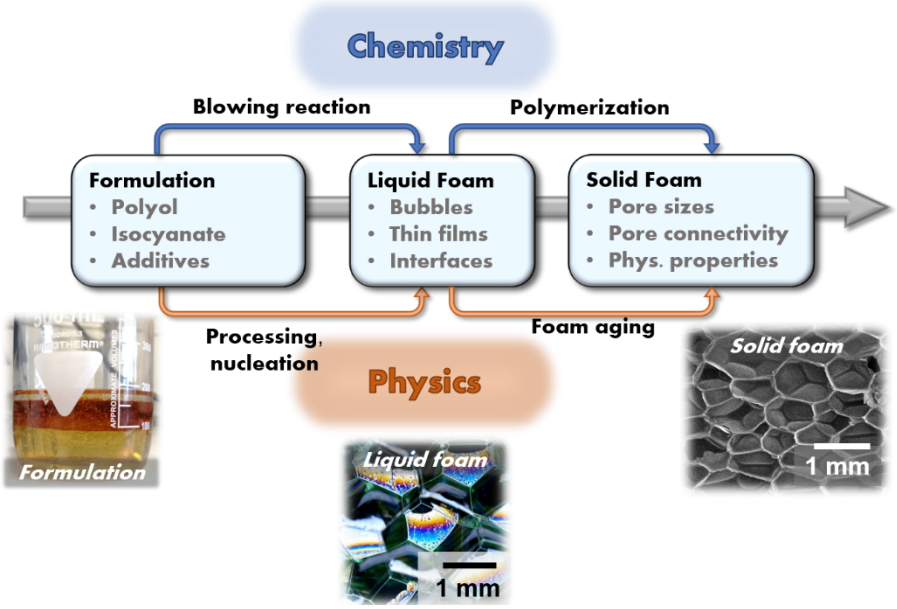
Martin Hamann

Morphology Control of Polyurethane Foams

PhD Defense: December 1st 2022 at 13:30

The physical properties of polyurethane (PU) foams depend fundamentally on their porous morphology. However, controlling PU foam morphology is challenging, as the generation of a PU foam is a complex process involving many interrelated chemical and physical phenomena (see Figure below). Thus, the aim of this thesis was to understand the mechanisms allowing for an efficient control over the porous PU foam morphology with a particular focus on reducing the mean pore size. We proved that the mean pore size depends quantitatively on the number of micrometric air bubbles entrained during mixing of the PU foam's reactive components. Moreover, we studied the pore size reduction associated with the addition of fluorocarbons (FCs) to PU foam formulations. We showed that most of the explanations given in the literature are erroneous and that FCs primarily help to entrain more air bubbles during mixing which, in turn, leads to the formation of smaller pores. Moreover, we investigated the underlying physico-chemical mechanisms that lead to an increased number of air bubbles being generated during mixing in the presence of FCs. This new understanding will help to identify environmentally friendly alternatives to fluorocarbons.



Supervisor: Dr. Wiebke Drenckhan, Insitut Charles Sadron

Jury: Prof. Dr. Miguel-Angel Rodríguez-Pérez, University of Valladolid (Spain)
Dr. Françoise Méchin, INSA Lyon
Dr. Arnaud Saint-Jalmes, Université Rennes I
Dr. Marie-Pierre Krafft, Institut Charles Sadron

NOTE: This PhD project is conducted in collaboration with an industrial sponsor such that the insights obtained during this thesis are subject to a **confidentiality agreement.** As a consequence, the thesis defense is **not** open to the public. Persons wishing to attend the defense may contact Wiebke Drenckhan and Martin Hamann.