About Monodisperse Polymer Foams And
Gelled Complex Fluids

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Part I Monodisperse Polymer Foams

Combining the concept of emulsion templating with microfluidics we generated monodisperse, highly-ordered polymer foams with specific morphologies. Surprisingly, the polymerization of the same monodisperse emulsion template leads to completely different morphologies if one changes the locus of initiation. Monodisperse open-cell foams with spherical pores are obtained if one initiates the polymerization from the bulk phase. Monodisperse closed-cell foams with honeycomb structures are obtained if one initiates the polymerization from the oil/water interface. In order to explain the differences in pore shape and connectivity we propose that an osmotic transport redistributes matter in the case of interface initiation, while this does not happen in the case of bulk initiation. Being able to control very precisely the morphology of a polymer foam opens up a new arena for the development of lightweight materials with optimized mechanical properties.

Part II Gelled Complex Fluids

Typical examples of complex fluids are micellar solutions, lyotropic liquid crystals, thermotropic liquid crystals, microemulsions, and emulsions. A gel, on the other hand, consists of a gelator and a solvent and can be defined as a dilute cross-linked system which exhibits no flow in the steady state. The unique selling point of gelled complex fluids is the fact that the two coexisting structures can take over two different functions. Gelled complex fluids are soft materials in which the microstructure of the complex fluid is combined with the mechanical stability of a gel. To obtain a gelled complex fluid one either adds a gelator to a complex fluid or replaces the solvent in a gel by a complex fluid. The most prominent example of a „natural“ gelled complex fluid is the cell. There are various strategies via which one can form a gelled complex fluid one of which is orthogonal self-assembly, i.e. the independent but simultaneous formation of two coexisting self-assembled structures within one system. This contribution aims at describing the structure and potential applications of various gelled complex fluids and at clarifying whether the respective system is formed via orthogonal self-assembly. For this purpose, previous as well as current research activities will be presented and future perspectives will be addressed.