Out-of-equilibrium systems by dynamic and dissipative self-assembly


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The self-assembly of small molecules, polymers, proteins, nanoparticles and colloids under thermodynamic equilibrium conditions has been a powerful approach for the construction of a variety of structures of nano- to micrometer dimensions, like vesicles, capsules, and nanotubules. Despite these advances, the permanent nature of these synthetic self-assembled structures does not compare well to the complex spatiotemporally confined self-assembly processes seen in natural systems, which for instance allow the dynamic compartmentalization of incompatible processes, responsiveness, and self-healing. It remains a challenge to develop out-of-equilibrium systems through spatio- and temporal control over self-assembly.

In our research we focus on molecular approaches which allow control over self-assembly processes through covalent bond formation: (i) the development of dynamic covalent gelators, which allow spatial and temporal control over self-assembly by use of catalysts,[1,2] and (ii) dissipative self-assembly driven by a chemical fuel[3]. I will discuss the background of our approaches together with recent results, and will suggest how dynamic self-assembling systems may lead to the next generation of responsive, nanostructured and self-healing materials.

Reference to publications: