

Synthesis of Smart Microgels in a Flow Reactor

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Through years of intensive research, polymer networks of smart microgels have intensively been studied in *offline* experiments with different techniques, like FT-IR spectroscopy[1], PCS[2] and SANS[3]. However, the mechanism of this precipitation polymerization has not been completely understood. *Online* experiments in combination with analytical methods may lead to an access of studying the polymer network formation *in situ*.

In a novel approach, we developed a flow reactor to synthesize microgels, based on crosslinked poly(*N*-isopropylacrylamide) (PNIPAM), by continuous flow. By changing the flow rate, we could see a dependency between the hydrodynamic radius r_h of the particles and the retention time t_r in the flow reactor in first *offline* experiments (Fig. 1).

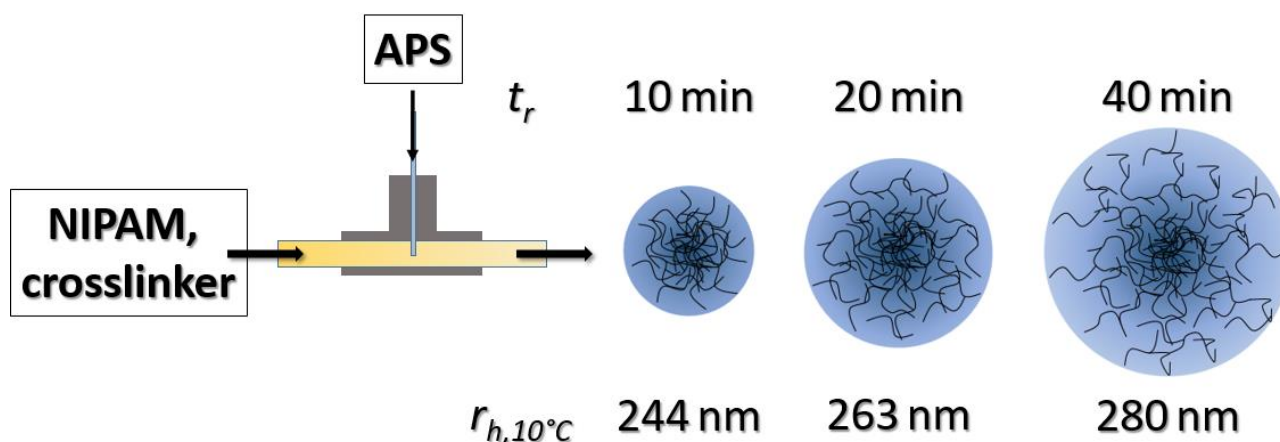


Figure 1. Schematic illustration of the synthesis of crosslinked PNIPAM-microgels in a flow reactor at different retention times t_r , after initiation with ammonium peroxodisulfate (APS). The collected samples were purified and then characterized by dynamic light scattering. The hydrodynamic radius at 10 °C $r_{h,10^\circ\text{C}}$ increases with t_r .

As a next step, we will combine our system with FT-IR spectroscopy to observe changes in characteristic vibrational modes of the monomer. In the long term, we will connect this setup to other analytical methods, like SAXS and SANS to study the formation of polymer networks *in situ*.

[1] L Wiehemeier *et al.*, *Phys. Chem. Chem. Phys.* **21** (2019), 572-580.

[2] B R Saunders, B Vincent, *J. Chem. Soc., Faraday Trans.* **92** (1996), 3385-3389.

[3] K Kratz, *Polymer* **42** (2001), 6631-6639.

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