Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Synthesis of oligomer and polymer grafted SiO_2 particles to make colloidal gels

Contacts:
Prof. Jan Vermant (jan.vermant@mat.ethz.ch)
Florence Müller (florence.mueller@mat.ethz.ch

Project description

Silica (SiO2) particles are used in various applications, such as storage and high-performance catalysis, but also academic applications, where silica nanoparticles are used as building blocks for a colloidal gel network. SiO_2 particles can be fabricated using different strategies, one of which being the well understood “Stöber process” [1], where a silane such as tetraethyl orthosilicate (TEOS) is added to a mixture of ethanol, water and ammonia. The particle size can easily be tuned by changing the composition of the mixture to get monodisperse colloids [2]. By grafting the particles with oligomers or polymers, we can add functionalities to the particles. In earlier work, we developed a modular synthesis approach to functionalize SiO_2 particles of different shapes and sizes using click-like chemistry. Until now, we have grafted octadecanol (C_{18}) to make thermoreversible gels in tetradecane.
In this project, we would like to graft different oligomers and polymers to the particles surface, by still using the click-like chemistry approach. To this end, we would functionalize different oligomers/polymers (Fatty alcohols, PEG, PEG-PCL,…) with an alkynoate group using the fisher esterification process and graft them to home-made secondary amine functionalized SiO_2 particles. In a second step, we will assemble these particles into gels and characterize them.

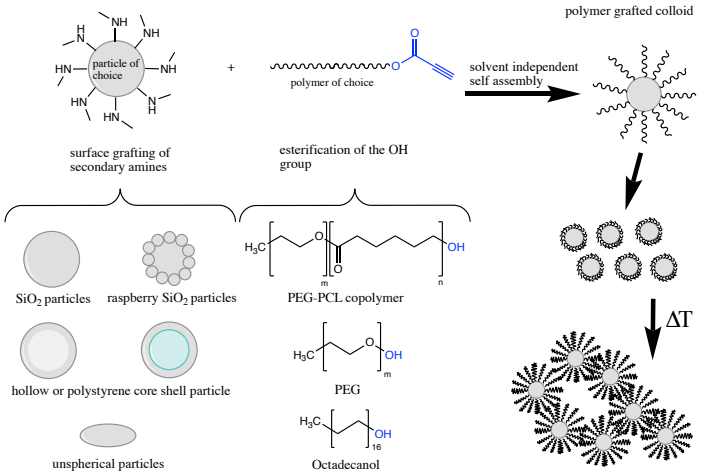

Fig. 1. Synthesis method for surface grafted particles

Methods used in the project

- Chemical synthesis
- Scanning electron and atomic force microscopy (SEM/AFM)
- Dynamic laser scattering (DLS)
- Thermogravimetric analysis (TGA)

References

1. Stöber, W., A. Fink, and E. Bohn, *Controlled Growth of Monodisperse Silica Spheres in the Micron Size Range.* Journal of Colloid and Interface Science, 1968. **26**.
2. Greasley, S.L., et al., *Controlling particle size in the Stöber process and incorporation of calcium.* J Colloid Interface Sci, 2016. **469**: p. 213-223.