

Synthesis and Modification of Nanoparticles based on inorganic Polycondensates

This dissertation presents the synthesis of spherical SiO₂- / TiO₂- nanoparticles which show special characteristics with regard to the preparation of photonic crystals. These properties are - among others - the particle size, the size distribution (monodispersity), the optical density as well as the interactions in dispersions.

Based on the method of Stöber et al. colloids with a narrow size distribution are prepared by ammoniumhydroxide catalyzed hydrolysis and condensation reactions of tetraethoxysilanes or titaniumalcoxides and -trimethylsiloxides. The size of the particles can be performed by a variation of different reaction parameters (monomer-, NH₃-, H₂O-concentrations, solvents, temperature) as well as by cocondensation to core particles (Seed-Growth-techniques). This method additionally offers the opportunity to realize core/shell-systems.

The optical characteristics (index of refraction, absorption), as well as the aggregations- resp. sedimentation attitudes vary by different modifications. On the one hand, the utilization of hetero materials in the oxide matrix (i. e. transition metals, dyes) offers an effect on the optical characteristics, on the other hand, the interaction of the particles can be affected by surface modifications/functionalizations with organylalcoxysilanes.

The colloid particles are characterized by dynamic (DLS) and static (SLS) light scattering, electron microscopy, MAS-NMR-spectroscopy, EPR-spectroscopy as well as UV/Vis-spectroscopy.