

Macroscopic assemblies of nanocrystals and their applications

Prof. Alexander Eychmüller (Physical Chemistry, Technische Universität Dresden, Dresden, Germany)

Some 35 years ago the so-called size quantization in semiconductor nanocrystals has been found and explained correctly. Since then enormous progress has been made in various directions: quality of the materials (measured as size dispersity, crystallinity, compositional variability, surface functionalization, etc.), applications (in lighting, bio-environments, solar cells, etc.), as well as basic theoretical understanding.

The **first lecture** of this course will touch upon some of the basics of nanocrystal synthesis in colloidal solution, their characterization, properties and fields of applications. These applications will already include those which rely on surface functionalization and, hence, incorporation of particles into various matrices.

The **second lecture** will be devoted to ordered superstructures of nanoparticles. I'll introduce some of the fascinating work on binary nanoparticle superlattices before shifting to three dimensionally ordered systems. These ordered superstructures (mesocrystals) from our lab are composed of IV-VI semiconductor nanocrystals (8 – 15 nm in diameter) and stretch to dimensions in the 100 micrometer range. In the latter superstructures the nanocrystals exhibit remarkable photostabilities and enhanced emission quantum yields holding promise for colour conversion applications.

In the **third lecture** the focus will be laid on non-ordered superstructures made from nanocrystals. Here, gels and aerogels manufactured from a variety of different nanoparticles have recently proven to provide an opportunity to marry the nanoscale world with that of materials of macro dimensions, which can be easily manipulated and processed, whilst maintaining most of the nanoscale properties. The materials carry an enormous potential for applications. This is largely related to their extremely low density and high porosity providing access to the capacious inner surface of the interconnected nano-objects they consist of.

Prerequisites for attending the lecture: Having in mind the diversity of the audience, I should (and will) begin more or less on high school levels of Chemistry and Physics and not digging much deeper, probably one (simple) equation will be introduced, the rest will be more or less colourful pictures.