

## **Colloidal Nanocrystals - Building Units for Microscopic And Macroscopic Materials**

The high degree of control over colloidal nanoparticle shapes, sizes, materials and material compositions normally goes along with the problem that the resulting nanocrystals are in a solution limiting their application spectrum. Therefore, recently the assembly of nanocrystals has emerged as a possible route to solve these problems.

In this presentation, first the synthesis of high-quality nanocrystals will be presented. Subsequently, a broad spectrum of assembled structures as novel functional materials is presented ranging from microscopic densely-packed to macroscopic porous assemblies.

For example, multifunctional microscopic colloidal nanobeads with applications in biomedicine will be shown. A different example of new materials which will be presented is the class of hydro- and aerogel materials, which have emerged as novel macroscopic self-supporting networks of nanoparticle building blocks. These ultralight materials might help bridging the gap between the macroscopic and the nanoscopic world, with applications in catalysis, electro- and photocatalysis, photoelectrochemical sensing and many more. Examples ranging from nanocrystal synthesis to novel synthetic assembly strategies such as the cryogelation method will be presented. The physicochemical properties of these materials as derived from optical spectroscopy, nitrogen adsorption and electron microscopy will be discussed, as well as possible applications. It will be demonstrated that in some cases physical properties are observed which are different from both, those of their building blocks and those of the respective bulk materials. This indicates that aerogels can exhibit physical properties which are achievable by no other means.