STABILITY AND SELF-ASSEMBLY OF NANO-OBJECTS WITH DIFFERENT SHAPE

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Abstract

Stability and self-assembly of nano-objects (NOs) into complex structures are important issues related to their application i.e. in stimuli-responsive systems. The stability of NOs depends on their size and properties of ligands used for their functionalisation. For example, NOs coated with 11-mercaptoundecanoic acid (MUA) or N,N,N-trimethyl(11-mercaptoundecyl) ammonium chloride (TMA), are water soluble due to the presence of electric charge (negative or positive respectively). The stability of these NOs results from electrostatic repulsion between particles and therefore can be controlled by pH and the concentration of inorganic salts. Such condition-dependent properties of NOs allows for their controllable self-assembly into complex, three-dimensional structures.Here we present the result of studies on the stability and self-assembly of MUA- and TMA-coated both spherical and elongated NOs (nanoparticles and nanorods) in aqueous solutions. We verified the stability of NOs in different pH or ionic strength by means of UV-vis spectrophotometry, dynamic light scattering (DLS) and zeta-potential measurements. Next we mixed nanoparticles and nanorods which carry the same- or opposite charge and monitored their self-assembly in solutions. Finally, we investigated the structures formed by NOs in solution after transferring onto solid substrate by means of scanning electron microscopy (SEM). As a main result we show that depending on the experimental conditions, nanoparticles and nanorods can form either small nanoscopic assemblies like nanoparticles-decorated nanorods, or significantly bigger, crystal-like structures whose size can be up to micrometers.

Keywords: Nanoparticles, nanorods, stability, self-assembly

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