CdSe Nanoplatelets Living Polymers

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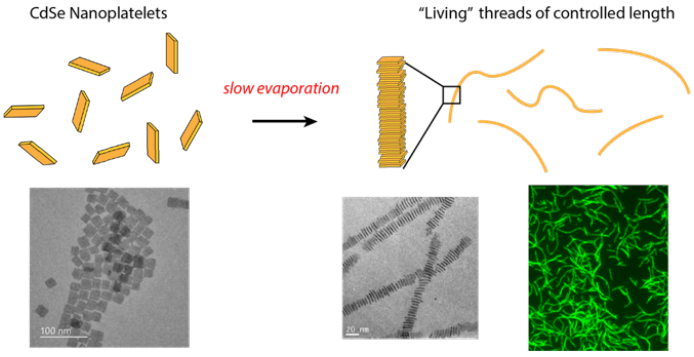

Self-assembly of colloidal CdSe nanoplatelets into long threads of controllable length.

Colloidal nanoplatelets (NPLs), which are also known as colloidal quantum wells, are light emitting materials exhibiting unique optical properties making them promising for light emitting diodes and lasers [1,2]. These properties include narrow photoluminescence full-width at half-maximum ($\simeq$8 nm) and absence of inhomogeneous broadening [3]. Recently, NPLs have been found to assemble into micrometers long anisotropic needle-like superparticles by addition of anti-solvent to a stable colloidal solution [4]. Interestingly, these anisotropic large particles display polarized light emission. In this work, we present face to face self-assembly of two dimensional thin CdSe nanoplatelets into one dimensional micrometer length anisotropic CdSe threads-like networks. We demonstrate a facile strategy for assembling 2D square quantum wells into 1D micrometer length thread-like structures consisting of repeated and fixed gaps along the longitudinal direction. These structures are flexible since they are composed of a single platelet in their lateral dimension and continuously break and reform in solution similar to wormlike micelles formed by some surfactants. Fine-tuning of the length of these nanoparticle polymers is achieved by varying the experimental conditions. Interestingly, their formation is a non-equilibrium process and once formed, they can be manipulated and redispersed in solution while keeping their very bright emission. Optical fluorescence microscopy, transmission electron microscopy provide detailed structural characterization and show that threads can be composed by highly organized 100 to 1000 nanoplatelets. These 1-dimensional structures are flexible and feature a "living polymer" character since threads of a given length can be further grown through the addition of supplementary nanoplatelets at their reactive ends [5].

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