Self-Assembly of CdSe Nanoplatelets into « living » Threads of controlled length

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Colloidal CdSe nanoplatelets are light emitting materials which exhibit outstanding optical properties[1,2]. They are considered to be excellent candidates for many applications in nanotechnology due to their fast fluorescence lifetime and their small spectral linewidth. One of the current challenges is to self-assemble these colloidal quantum wells into large ordered structures to control their collective optical properties. We describe a simple and robust procedure to achieve controlled face-to-face self-assembly of CdSe nanoplatelets into micron-long polymer-like threads made of up to ~1000 particles. Optical fluorescence microscopy, transmission electron microscopy provide detailed structural characterization and show that threads can be composed by highly organized 100 to 1000 nanoplatelets. Small-angle X-ray scattering of CdSe threads in solution shows a strong peak at wave vector q=1.23 nm^{-1} corresponding to the 001 stacking reflection with period 5.1 nm which is center to center distances of two nearest platelets in CdSe threads.
These structures are formed by addition of oleic acid to a stable colloidal dispersion of platelets, followed by slow drying and re-dispersion. We could control the average length of the CdSe nanoplatelet threads by varying the amount of added oleic acid. Since they are compsoed of a single platelet in their lateral dimension, these structures are highly flexible. Furthermore, they continuously break and reform in solution.They also feature a "living polymer" character because threads of a given length can be further grown through the addition of supplementary nanoplatelets at their reactive ends.[3]

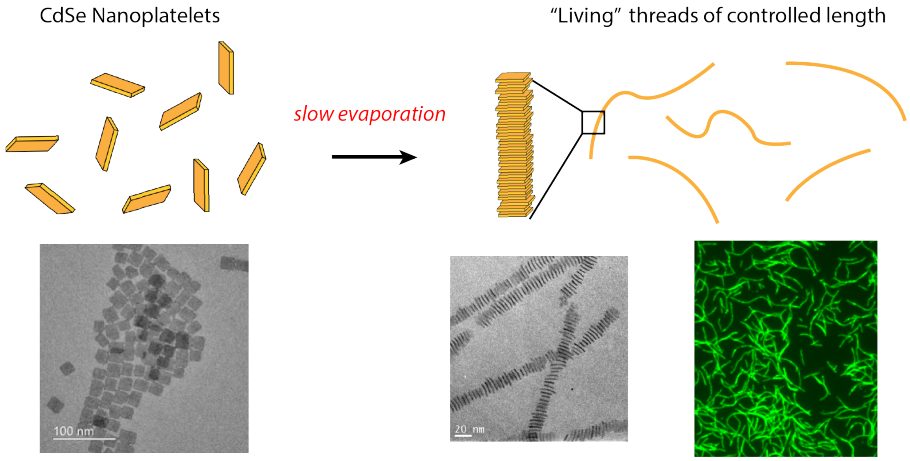

Fig. 1: self-assembly of stacked nanoplatelets into long threads of controlled length.

1) Ithurria, S.; Tessier, M. D.; Mahler, B.; Lobo, R. P. S. M.; Dubertret, B.; Efros, A. L. *Nature Materials* **2011**, *10* (12), 936.
2) Ithurria, S.; Dubertret, B. *Journal of the American Chemical Society* **2008**, *130* (49), 16504.
3) Jana, S.; Davidson, P.; Abécassis, B. *Angewandte Chemie International* **2016**, 55 (32), 9371.