Seeded growth of CdSe/CdS core/shell nanoplatelets

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Colloidal nanoplatelets are quasi-two-dimensional nanocrystals with atomically precise thicknesses. As a result of their well controlled geometry, CdE (E=Se, S, Te) nanoplatelets show much narrower absorption and emission linewidths than quantum dots [1]. This makes nanoplatelets very interesting candidates for optical and optoelectronic applications where spectrally pure emission is desired. However, bare nanoplatelets show insufficient photo- and/or chemical stability. This can be overcome by coating the nanoplatelets with a shell of an appropriate material. Furthermore, in the case of CdSe/CdS core/shell nanoplatelets the introduction of the shell shifts the emission wavelength towards the red. Thus, the shell also introduces an additional means to tailor the properties of the nanoplatelets.

Due to their two-dimensional geometry, nanoplatelets are thermodynamically much less stable at elevated temperatures than quantum dots. Furthermore, the strong passivation of the large nanoplatelet surface facets with carboxylate ligands, which is critical for the formation of nanoplatelets, also hampers the growth of the shell [2]. This makes the development of a coating protocol significantly more difficult as it has to ensure that the nanoplatelets do not undergo etching or ripening during the process. As a result, only a very limitted number of synthetic routes have been developed to coat nanoplatelets with a shell, and most of them involve multiple reaction steps [3, 4]. There, the shell is grown layer by layer by alternatively adding S and Cd layers.

Herein, we present a new aproach to grow the shell of CdSe/CdS nanoplatelets by a modification of an established seeded growth method for core/shell quantum dots [5]. By carefully minimizing etching of the CdSe nanoplatelets in the initial stage of the coating we synthesize uniform, monodisperse, and bright core/shell nanoplatelets while retaining their narrow emission. We monitor the growth of the shell to understand the transformation of the initial CdSe nanoplatelets to the final CdSe/CdS core/shell structure. Lastly, we are able to control the shell thickness and, thereby, the emission wavelength of the core/shell nanoplatelets by tracking the temporal evolution of the absorbtion and emission spectra.

1) S. Ithurria *et al.*, *Nat Mater*, **2011**, *10*, 936.
2) A. Riedinger *et al.*, arXiv:1605.06553, **2016**.
3) S. Ithurria *et al.*, *J. Am. Chem. Soc*., **2012**, *134*, 18585.
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5) O. Chen *et al.*, *Nat Mater*, **2013**, *12*, 445.