Size, Shape and Phase Control in Ultrathin CdSe Nanosheets

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Ultrathin two-dimensional nanosheets raise a rapidly increasing interest due to their unique dimensionality-dependent properties. Most of the two-dimensional materials are obtained by exfoliation of layered bulk materials or are grown on substrates by vapor deposition methods. To produce free-standing nanosheets, solution-based colloidal methods are emerging as promising routes.

In this work, we show that the size, shape and phase of ultrathin colloidal CdSe NSs can be controlled by the addition of halogenated compounds to the synthesis. For example, with increasing amounts of 1-bromoheptane the shape can be tuned from sexangular to quadrangular to triangular and the phase changes from zinc blende to wurtzite. We systematically investigate the influence of the chemical structure of the bromoalkanes as well as the type of the halogen atom in the additive to understand the role of halogen compounds and to investigate the growth mechanism of the CdSe NSs. Our experimental findings show that the geometry and crystal structure evolution of the nanosheets take place in the presence of halide ions, acting as cadmium complexing agents and as surface X-type ligands, according to mass spectrometry and X-ray photoelectron spectroscopies.