BRANCHING IN COLLOIDAL CdTe NANOCRYSTALS

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Colloidal nanocrystals are highly versatile materials because their physico-chemical properties can be finely tuned by controlling their size, shape and composition. These nanocrystals are chemically accessible and can be cheaply processed. Recently, several reports on tetrapod branched nanocrystals have been published, although the mechanism of their formation has not been entirely clarified so far.[1, 2] The design and the fabrication of complex nanocrystals is therefore still a challenging task and calls for a deeper understanding of nanocrystal growth thermodynamics and kinetics.

We have developed a synthetic approach to a variety of CdTe nanocrystal shapes, which uses as templating surfactants a mixture of methyl phosphonic acid (MPA) and octadecylphosphonic acid (ODPA). In this system, pure ODPA generates nearly spherical nanocrystals. Low concentrations of MPA lead mainly to rod-shaped nanocrystals, whereas higher concentrations lead to branched structures (bipods, tripods and tetrapods). At even higher concentrations of MPA, multiple branched nanocrystals are formed. No trace of cubic sphalerite could be found in high resolution TEM analysis on the samples prepared, and branching points resulted from the junction of different wurtzite domains trough a variety of twin planes. Therefore, the branching, which is triggered by MPA, is not caused by the coexistence of a sphalerite nucleus (the "branching point") and hexagonal arms (the "branches") as previously postulated, but is due to the formation of multiple twins, most likely during the nucleation stage.

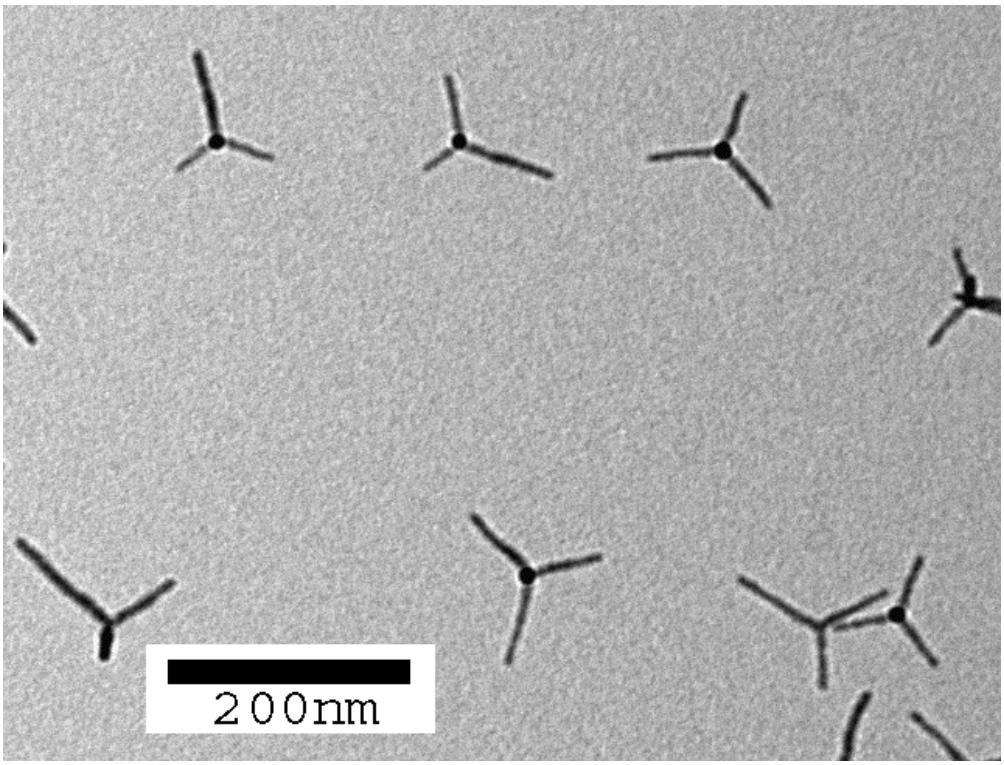

Figure: CdTe tetrapods, intermediate percentage of MPA.

References:

1. Manna, L.; Milliron, D. J.; Meisel, A.; Scher, E. C.; Alivisatos, A. P., Controlled growth of tetrapod-branched inorganic nanocrystals. *Nature Materials* **2003,** 2, (6), 382-385.
2. Manna, L.; Scher, E. C.; Alivisatos, A. P., Synthesis of soluble and processable rod-, arrow-, teardrop-, and tetrapod-shaped CdSe nanocrystals. *Journal of the American Chemical Society* **2000,** 122, (51), 12700-12706.