Experimental Observation of Two-Dimensional Ostwald Ripening in Semiconductor Nanoplatelets

Philippe N. Knüsel[a], Andreas Riedinger[a], Aurelio Rossinelli[a], Florian D. Ott[a], Aniket Mule[a], David J. Norris[a]

[a] *Optical Materials Engineering Laboratory, ETH Zurich, Zurich, Switzerland*

The synthesis of colloidal semiconductor nanoplatelets presents an intriguing violation of commonly accepted crystallographic principles, because it involves two-dimensional crystal growth in a cubic material. For zinc blende CdE (E = S, Se, Te) nanoplatelets, symmetry breaking occurs because of an intrinsic kinetic instability that leads to enhanced growth on narrow facets if the growth is not diffusion-limited. Here, we synthesize small (“baby”) nanoplatelets and experimentally show that under non-diffusion-limited conditions, thicker nanoplatelet populations will grow laterally at the expense of thinner ones that dissolve. We use this theoretically predicted form of Ostwald ripening to investigate the growth mechanism of colloidal nanoplatelets. By mixing different materials, we are able to synthesize core-crown nanoplatelets, hence demonstrating material transfer between the individual nanoplatelets. Furthermore, we directly grow nanoplatelets in a thin film of metal carboxylates, thus showing how Ostwald ripening can be applied as a facile and potentially versatile concept for nanoplatelet thin film synthesis.