Supporting Information for

PbSe Nanocrystal Shape Development: Oriented Attachment at Mild Conditions and Microwave Assisted Growth of Nanocubes

Mahmoud A. Sliem, Abdelkrim Chemseddine, Ulrike Bloeck, Roland A. Fischer

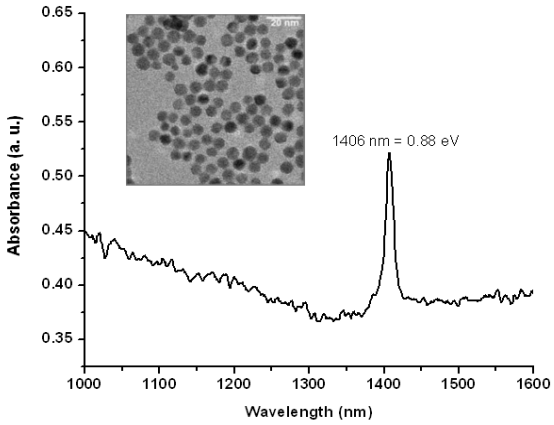

Fig. S1 NIR absorption spectrum of the 6.6 nm-size PbSe NCs. The inset shows the TEM image of the corresponding PbSe NCs. Absorption spectrum was measured utilizing UV/VIS/NIR spectrometer (OMEGA 20).

Due to the sharpness and spectral position of the spectrum, we thought that this absorption peak may belong to water/methanol dissolved in tetrachloroethylene or others like free oleic acid. Accordingly, the absorption spectra of water/methanol dissolved in tetrachloroethylene and also of oleic acid were measured and we did not detect any absorption in the spectral region of the detected peak. The sharpness of this peak probably attributed to the narrow size distribution of the measured sample. Additionally, Na et al. got absorption spectrum at 1405 nm for 6.5 nm-size PbSe nanodots very similar to what we got for 6.6 nm-size PbSe NCs (Supporting information of Na et al., J. Phys. Chem. C, 2008, 112, 11218).

However, the spectral position and the sharpness of the resulted peak are highly unusual because most of experimental and theoretical results suggest that 6.6-nm PbSe QDs should have an absorbance peak at about 2000 nm (B. L. Wehrenberg et al., J. Phys. Chem. B, 2002, 106, 10634; H. Du et al., Nano Lett., 2002, 2, 1321; Q. Dai, ACS Nano, 2009, 3, 1518). Additinally, from the width of the peak, one would estimate the size distribution to be less than 1%, roughly two orders of magnitude smaller than what is experimentally observed by B. L. Wehrenberg et al.(J. Phys. Chem. B, 2002, 106, 10634).

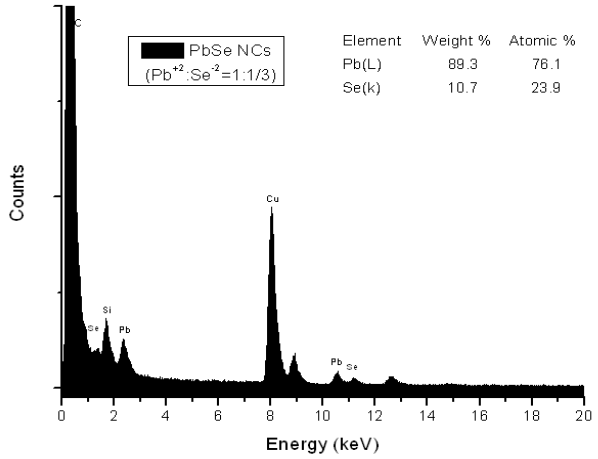

Fig. S2 Energy dispersive x-ray spectroscopy (EDS) was carried out on PbSe NCs in a Philips CM12 microscope with an accelerating voltage of 120 kV and equipped with a super twin lens to reveal Pb:Se in the ratio of 1:1/3. The presence of Pb and Se peaks confirm the complete intake of selenium ions by lead ions.

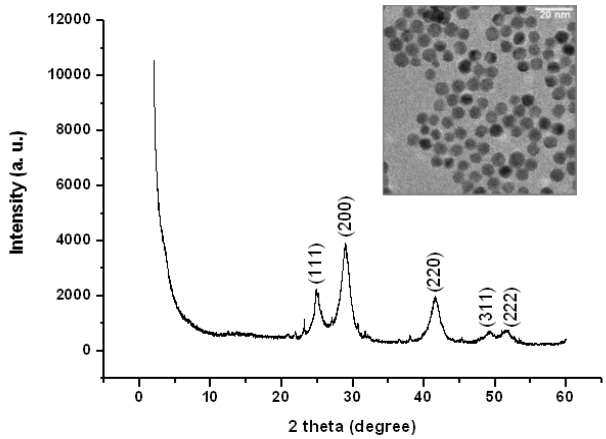

Fig. S3 X-ray diffraction pattern of 6.6-nm PbSe NCs indexed to the bulk rock-salt crystal structure. The sample's crystal size as calculated from line broadening by the Scherer's equation is 6.4 nm. The inset shows the TEM image of the corresponding 6.6-nm PbSe NCs. Powder XRD pattern was collected by a Siemens D500/5000 diffractometer, operating with a Cu anode at 45 kV and 30 mA.

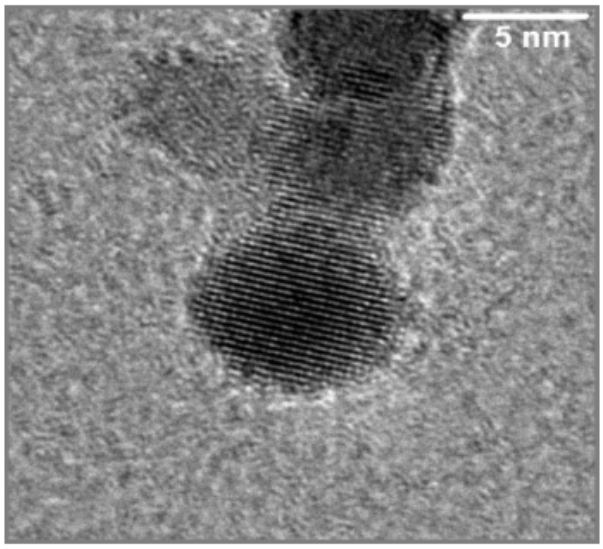

Fig. S4 HRTEM image shows a perfect attachment of 4 PbSe nanocrystals after addition of hydrous methanol followed by drying.

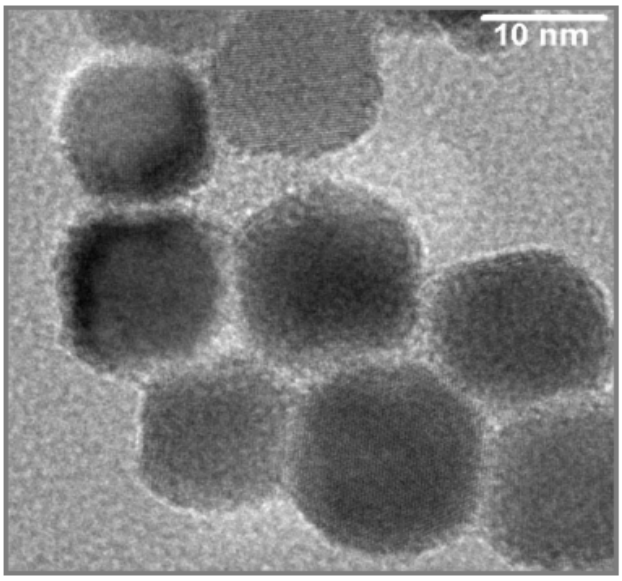

Fig. S5 HRTEM image shows arrangement of PbSe nanocrystals after addition of dry methanol followed by drying. The sufficient organics (oleic acids) around the PbSe NCs appear clearly and prevent the NCs from the attachment.

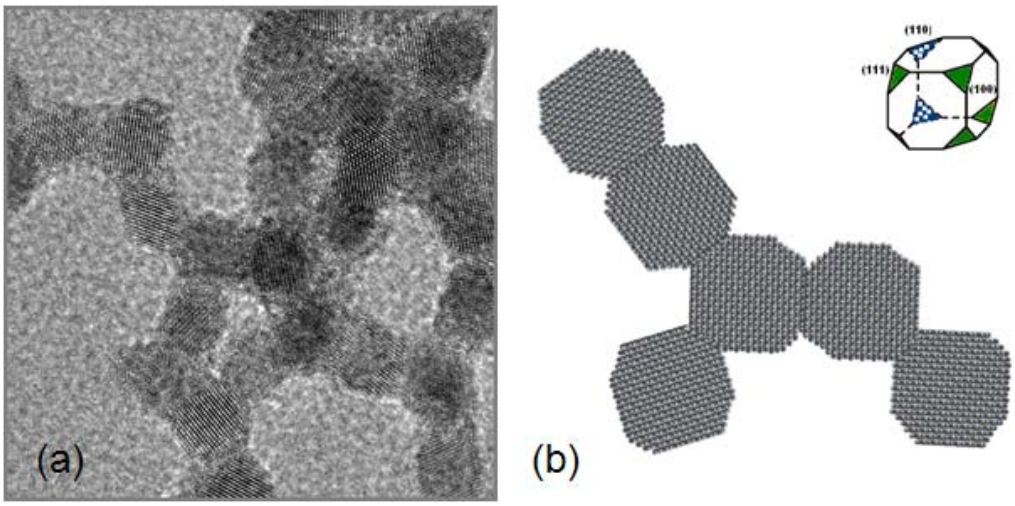

Fig. S6 a) HRTEM image shows the attachment of PbSe nanocrystals after addition of hydrous methanol followed by drying and b) The structural model of the oriented attachment of PbSe nanocrystals. Since the crystallographic arrangement can be fulfilled at any point of the particles' surfaces, the final architecture can result from several attachment occasions along the same surface, giving an uncontrollable shape. Inset of figure S5b shows the different crystalline phases of a rocksalt PbSe nanocrystal.