

University of Groningen

Quasi-seeded growth of ligand-tailored PbSe nanocrystals through cation-exchange-mediated nucleation

Kovalenko, Maksym V.; Talapin, Dmitri V.; Loi, Maria Antonietta; Cordella, Fabrizio; Hesser, Guenter; Bodnarchuk, Maryna I.; Heiss, Wolfgang

Published in:
Angewandte Chemie-International Edition

DOI:
[10.1002/anie.200705604](https://doi.org/10.1002/anie.200705604)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2008

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Kovalenko, M. V., Talapin, D. V., Loi, M. A., Cordella, F., Hesser, G., Bodnarchuk, M. I., & Heiss, W. (2008). Quasi-seeded growth of ligand-tailored PbSe nanocrystals through cation-exchange-mediated nucleation. *Angewandte Chemie-International Edition*, 47(16), 3029-3033.
<https://doi.org/10.1002/anie.200705604>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.



Supporting Information

© Wiley-VCH 2008

69451 Weinheim, Germany

Supporting Information for

Quasi-seeded growth of ligand-tailored PbSe nanocrystals through cation-exchange mediated nucleation

Maksym V. Kovalenko^{*,†}, Dmitri V. Talapin[‡], Maria Antonietta Loi[§], Fabrizio Cordella[§], Günter Hesser[†], Maryna I. Bodnarchuk[†], and Wolfgang Heiss[†]

*[†]Institute of Semiconductor and Solid State Physics, Johannes Kepler
University Linz, A-4040 Linz, Austria*

[‡]Department of Chemistry, University of Chicago, Chicago, IL 60637 (USA)

*[§]Zernike Institute for Advanced Materials, University of Groningen, 9747 AG
Groningen (The Netherlands)*

E-mail: maksym.kovalenko@jku.at, mvkovalenko@uchicago.edu

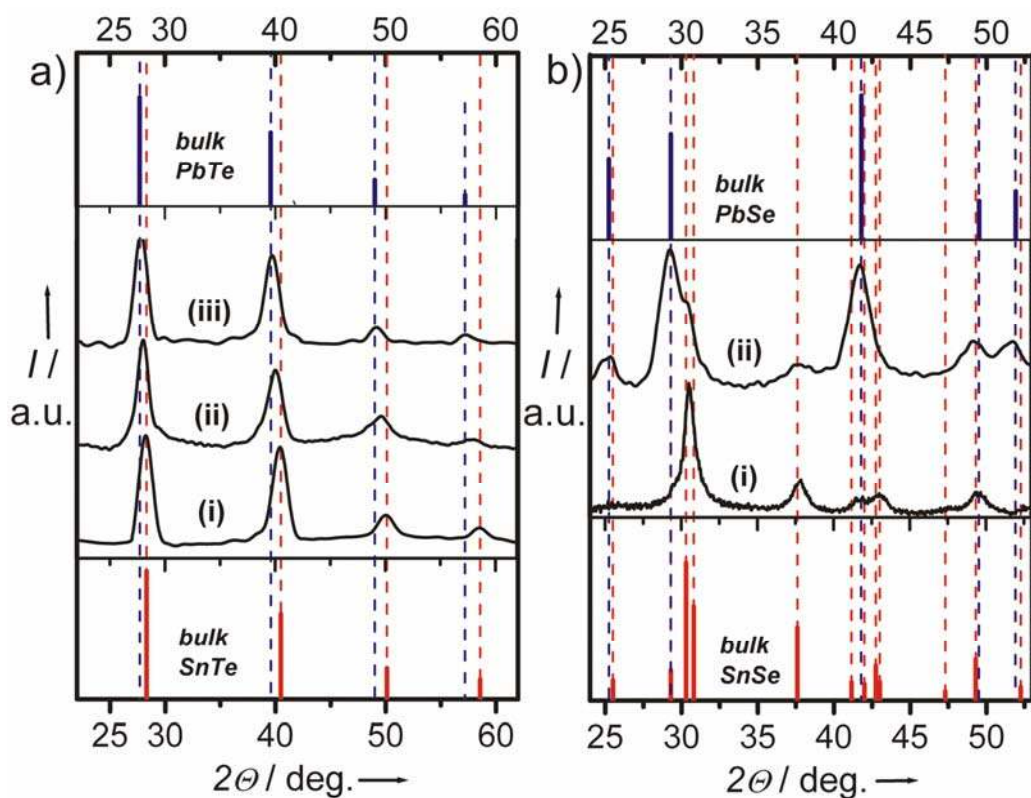


Figure S1. Evolution of powder XRD spectra as a result of the cation-exchange during the treatment of Tin chalcogenide NCs by PbCl_2 in OLA at 120°C . Fig. S1a represent powder XRD patterns of (i) as-synthesized SnTe NCs $[\text{SnTe}] = 0.5$ mmol, (ii) the same sample treated with 0.1 mmol of PbCl_2 and (iii) with another 0.4 mmol of PbCl_2 . Fig. S1b represent powder XRD patterns of (i) as-synthesized SnSe and (ii) the same sample treated with equimolar amount of PbCl_2 . Details of the synthesis of SnTe and SnSe NCs can be found in our previous report (Ref. 11f).

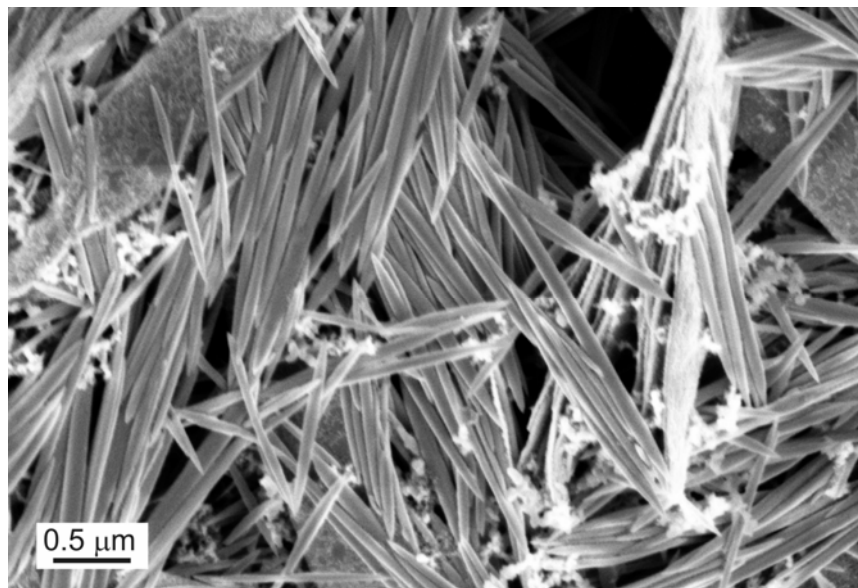


Figure S2. Elongated PbSe crystals formed upon the reaction between PbCl_2 and TOPSe in OLA in the absence of $\text{Sn}[\text{N}(\text{SiMe}_3)_2]_2$.

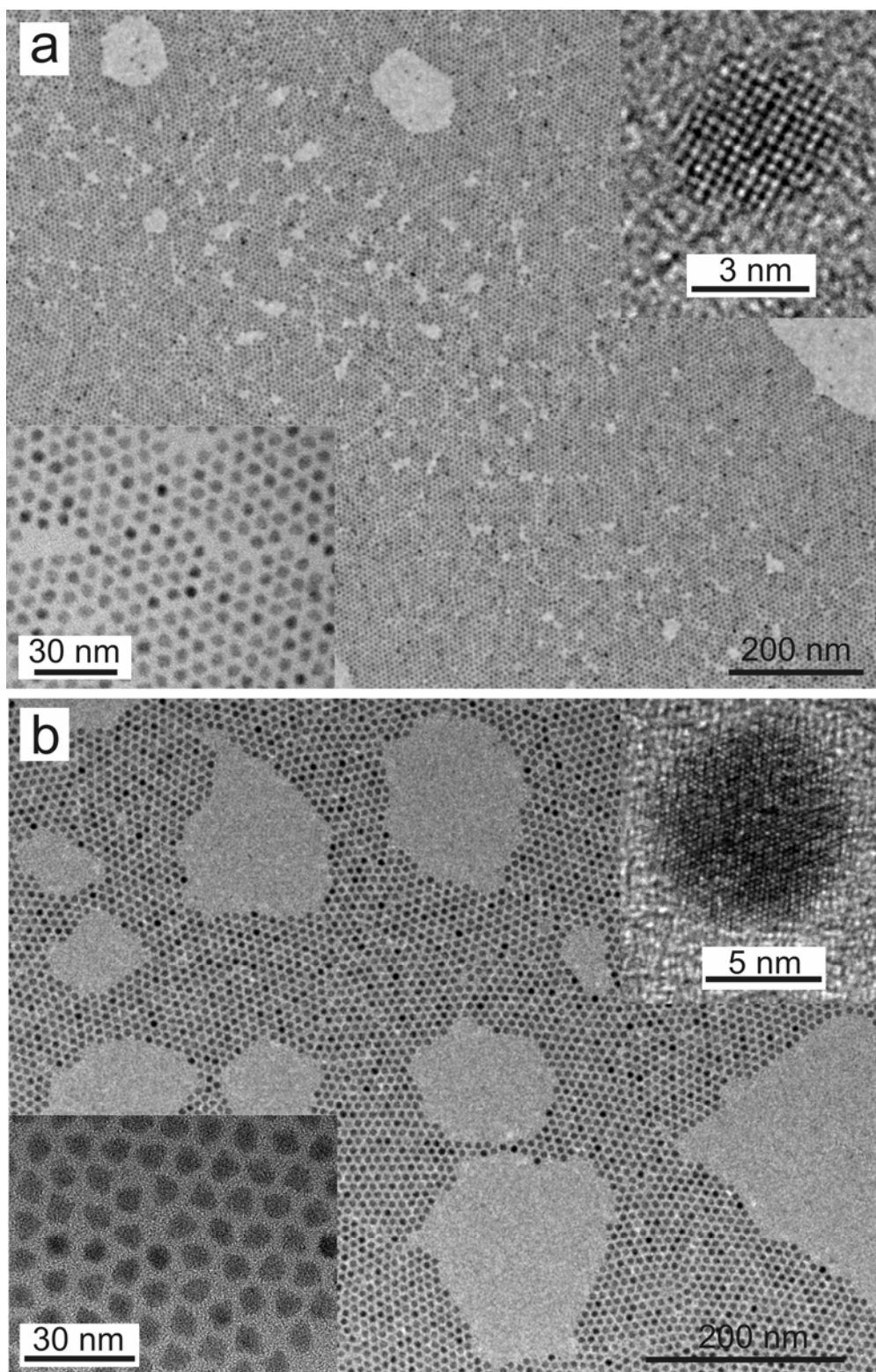


Figure S3. TEM overview of monodisperse 4.5 nm (a) and 7.2 nm (b) PbSe NCs synthesized via cation-exchange mediated nucleation. No post-synthetic size-selection was applied.

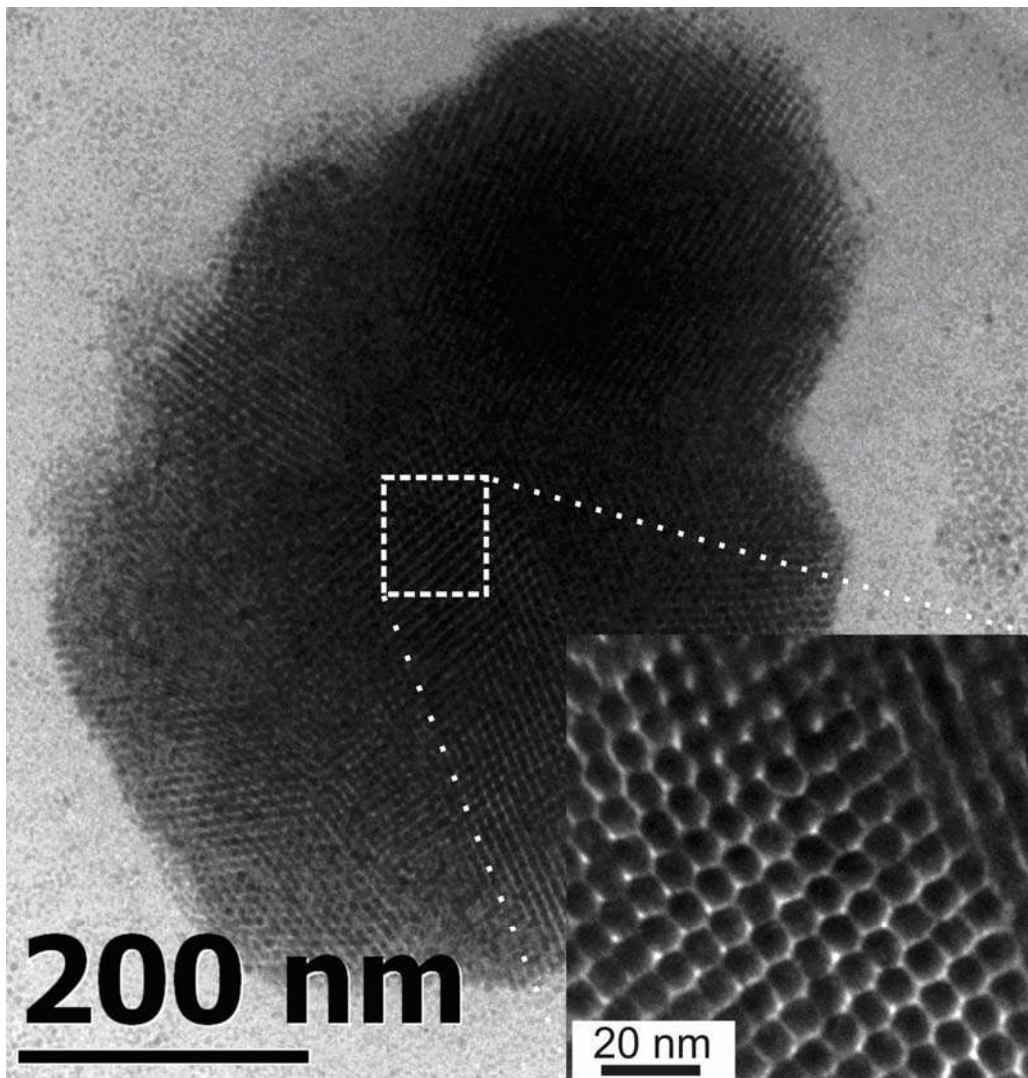


Figure S4. TEM images of a typical 3D superlattice domain formed on carbon-coated TEM grid by 8.1 large PbSe NCs upon fast evaporation of relatively concentrated colloidal solutions in tetrachloroethylene.

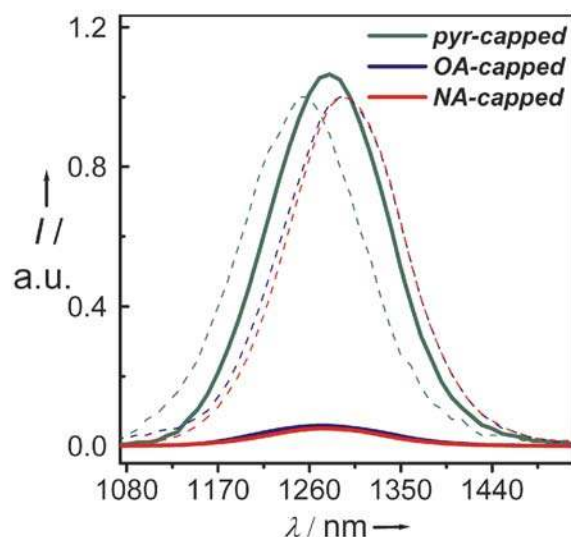


Figure S5. Steady-state PL spectra from nonanoic acid (NA)-, oleic acid (OA)- and pyridine-capped PbSe NCs in solutions (dashed lines, normalized) and in films (solid lines, true intensities).

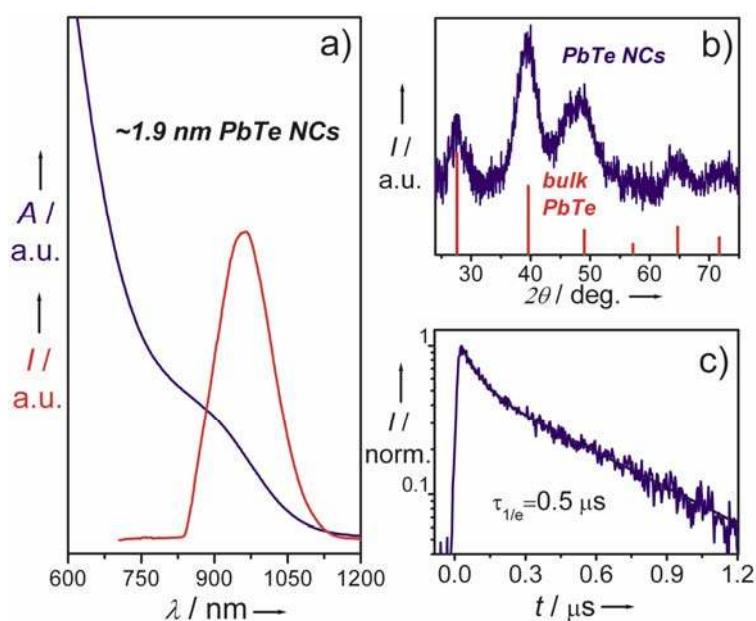


Figure S6. Optical and structural characterization of ~ 1.9 nm PbTe NCs synthesized via cation-exchange mediated nucleation. a) Optical absorption and emission spectra, b) powder XRD pattern and c) luminescence decay trace from the colloidal solution of PbTe NCs. For the synthesis of PbTe Ncs 50 μL of $\text{Sn}[\text{N}(\text{SiMe}_3)_2]_2$ and 4 mL of TOPTe solution (10% referring to Te) were injected into 7 ml of OLA containing 0.19 g of PbCl_2 at 140°C . The reaction was terminated 2 min after the injection. The NC size of 1.9 nm is an average of the estimations based on i) the analysis of the width (fwhm) of the (220) XRD reflection peak using the Scherrer formula (according to Cademartiri et al. *J. Am. Chem. Soc.* **2006**, *128*, 10337-10346) and ii) the extrapolation of the empirical size-dependence of the PbTe bandgap energy (Ref. 11e) to the energy of 1.23 eV (975 nm).