

Technical University of Denmark



Large CZTS Nanoparticles Synthesized by Hot-Injection for Thin Film Solar Cells.

Engberg, Sara Lena Josefin; Lam, Yeng Ming; Schou, Jørgen

Publication date:
2015

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):

Engberg, S. L. J., Lam, Y. M., & Schou, J. (2015). Large CZTS Nanoparticles Synthesized by Hot-Injection for Thin Film Solar Cells.. Poster session presented at 2015 E-MRS Spring Meeting, Lille, France.

DTU Library
Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

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.

Large CZTS Nanoparticles Synthesized by Hot-Injection for Thin Film Solar Cells

Sara Engberg^{(1)*}, Yeng Ming Lam⁽²⁾, Jørgen Schou⁽¹⁾

⁽¹⁾DTU Fotonik, Technical University of Denmark, DK-4000 Roskilde, Denmark

⁽²⁾School of Materials Science and Engineering, Nanyang Technological University, Singapore

* Corresponding author. Email: sleen@fotonik.dtu.dk

The kesterite material, $\text{Cu}_2\text{ZnSn}(\text{S}_x\text{Se}_{1-x})_4$ (CZTS), shows great promise as the absorber layer for future thin film solar cells. Solution processing allows for comparatively fast and inexpensive fabrication, and holds the record efficiency in the kesterite family. However, for nanoparticle (NP) solution processing to be a feasible fabrication route, the amount of carbon in the film has to be limited.

In our work, we try to limit the organic material in the film by synthesizing larger NPs. Larger particles can be obtained by longer reaction durations, slower reaction rates of the precursors, or slower injection rates of the sulfur/selenium precursors. In our group, we have synthesized NPs larger than 200 nm by controlling the monomer concentration during growth. Transmission electron microscopy (TEM) allows us to image the NPs and determine their individual composition.

Size-selective methods can be carried out in order to isolate the desired particle sizes, and films will be deposited through wet-chemical means. Mixing large NPs with small NPs can also improve the film-quality as a result of densification at the optimal packing density. The films are characterized by scanning electron microscopy (SEM) as well as other surface characterization techniques.

Our first photovoltaic device consisting of soda lime glass/Mo/CZTS/CdS/ZnO has been built from doctor blading of approx. 20 nm $\text{Cu}_2\text{ZnSnS}_4$ NPs in octanethiol, and annealed in Se-atmosphere. It had an efficiency of 1.4%.