



Carbon free CZTS inks synthesized at room temperature

Rein, Christian; Engberg, Sara Lena Josefin; Andreasen, Jens Wenzel

Publication date:
2020

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

[Link back to DTU Orbit](#)

Citation (APA):
Rein, C., Engberg, S. L. J., & Andreasen, J. W. (2020). *Carbon free CZTS inks synthesized at room temperature*. Poster session presented at Virtual Chalcogenide PV Conference 2020.

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.

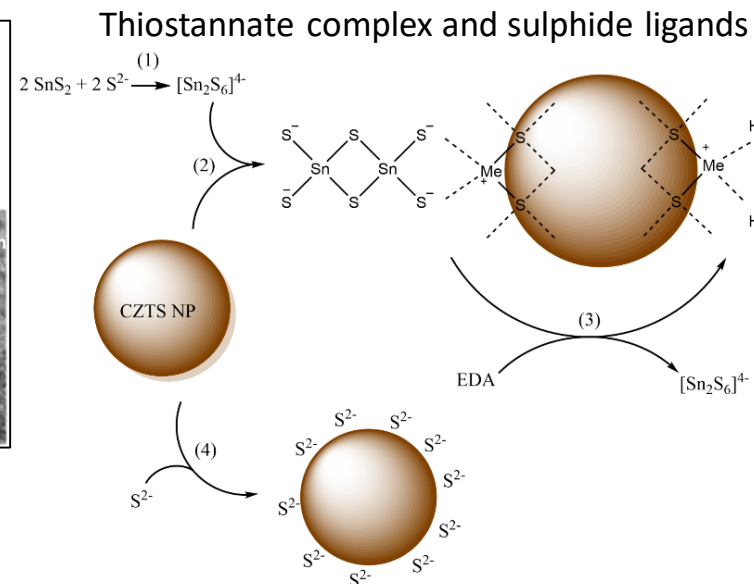
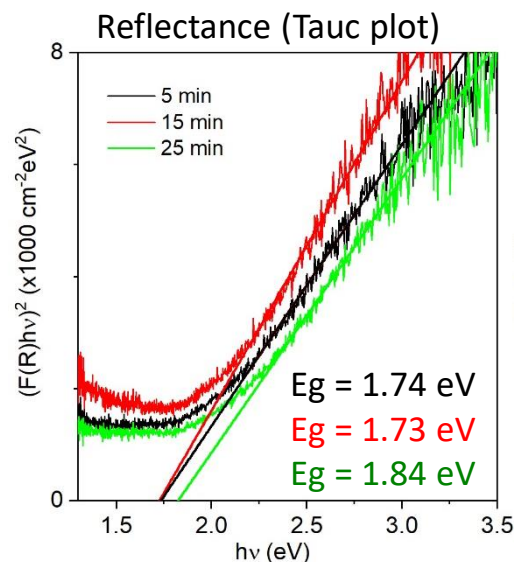
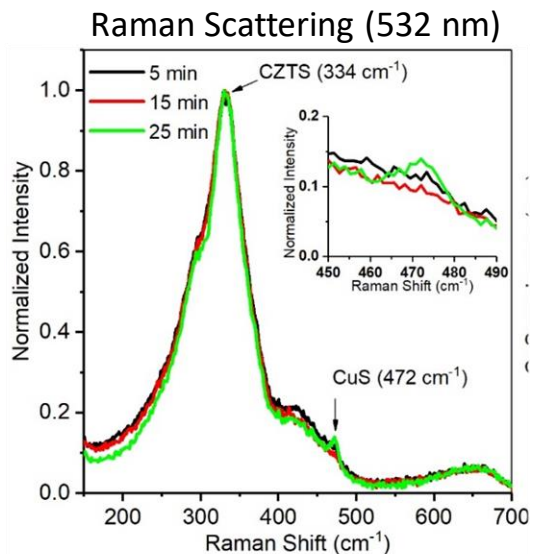
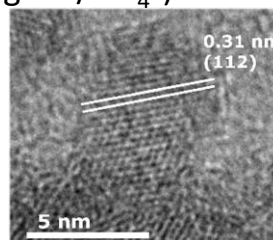
Carbon-free CZTS inks synthesized at room temperature

Christian Rein, Technical University of Denmark, Department of Energy Conversion and Storage

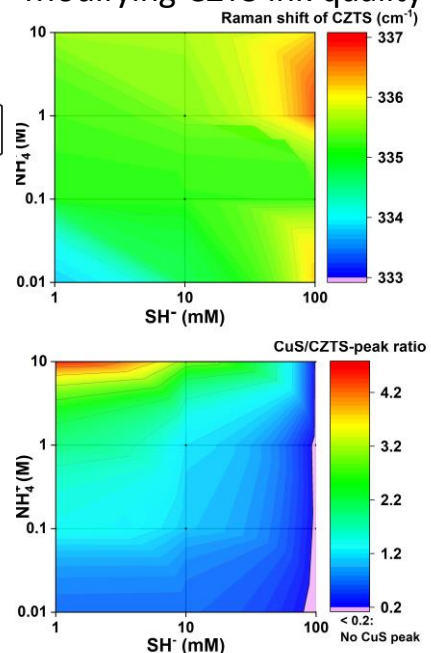
Project Summary

The need for high temperature processing has a significant negative effect on the Energy Pay-Back Time (EPBT) of photovoltaic materials, including copper-zinc-tin-sulfide (CZTS). We present the synthesis of CZTS nanoparticles (NPs) at room temperature and ink stabilization using small ions (e.g. S^{2-}/NH_4^+)*.

- Precursor 1: CuCl, ZnCl₂ and SnCl₂
- Precursor 2: NaSH (~30% excess)
- Reaction time (5-25 min) in N₂-filled glovebox.
- CZTS NP size: 6.15 ± 2.5 nm
- Cu_xS-formation threshold: Cu/Sn = 1.7



**NH₄⁺/SH⁻ ligands:
Modifying CZTS ink quality**



Project Impact

Carbon-free Ink formulations:

- Thiostannate complexes (can be displaced by EDA).
- Ammonium (promotes CuS).
- Sulfides (reverse CuS formation).

Co-authors/institutions

Sara Engberg, DTU Photonics, Technical University of Denmark (DTU).
Professor Jens W. Andreasen, Department of Energy Conversion and Storage, DTU.

Stable, carbon-free inks of Cu₂ZnSnS₄ nanoparticles synthesized at room temperature designed for roll-to-roll fabrication of solar cell absorber layers
Journal of Alloys and Compounds 787 (2019) p63 (DOI: 10.1016/j.jallcom.2019.02.014)

*Derived from method previously described (G. Larramona, RSC Adv. 4 (2014), p14655).