



Time-resolved X-ray Absorption Spectroscopy of Copper Zinc Tin Sulfide Nanoparticles

Rein, Christian; Haldrup, Kristoffer; Moltke, Asbjørn; Uhlig, Jens; Andreasen, Jens W.

Publication date:
2018

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):
Rein, C., Haldrup, K., Moltke, A., Uhlig, J., & Andreasen, J. W. (2018). *Time-resolved X-ray Absorption Spectroscopy of Copper Zinc Tin Sulfide Nanoparticles*. Abstract from Annual Meeting of Danish Physical Society 2018, Middelfart, 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.

Time-resolved X-ray Absorption Spectroscopy of Copper Zinc Tin Sulfide Nanoparticles

Christian Rein^{*1}, Kristoffer Haldrup², Asbjørn Moltke², Jens Uhlig³, Jens W. Andreasen¹

1 - DTU Energy, 2 - DTU Physics, 3 - Lund University

*Corresponding author: chrr@dtu.dk

Photovoltaic processes of the earth abundant and non-toxic $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) absorber material in 3. generation solar cells can be investigated by time resolved X-ray absorption spectroscopy (TR-XAS) using a synchrotron-based X-ray source and synchronized laser excitation (pump-probe method). Photovoltaic materials require efficient separation of photocarriers and charge mobility, but in CZTS, nanometer scale charge carrier localization has been observed to take place within the first 2 ps after excitation. Localization reduces mobility of charges and it is therefore important to know on what atoms these localizations occur in order to improve the efficiency of the CZTS absorber. We have investigated the carrier localization using pump-probe X-ray absorption spectroscopy (XAS) to track both the oxidation state of Cu and Zn atoms and their local bonding environments at the K-edges of the two metals – 8979 and 9659 eV for Cu and Zn, respectively. In addition, XAS also allow us to investigate the degree of Cu-Zn disorder in the material – the importance of which is still debated by researchers in this field. The investigated CZTS stabilized as a nanoparticle (NP) ink was used as a model system, which is also applicable for low-cost up-scaling of solar cells.

