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

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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, $Cu_2ZnSn(S_xSe_{1-x})_4$ (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 Cu_2ZnSnS_4 NPs in octanethiol, and annealed in Se-atmosphere. It had an efficiency of 1.4%.