



Pulsed laser deposition of $\text{Cu}_2\text{ZnSnS}_4$ absorber layers assisted by a reactive sulfur beam for solar cells

Estelrich, Joan Ramis; Canulescu, Stela; Traulsen, Marie Lund; Hansen, Karin Vels; Schou, Jørgen

Publication date:
2016

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

[Link back to DTU Orbit](#)

Citation (APA):

Estelrich, J. R., Canulescu, S., Traulsen, M. L., Hansen, K. V., & Schou, J. (2016). *Pulsed laser deposition of $\text{Cu}_2\text{ZnSnS}_4$ absorber layers assisted by a reactive sulfur beam for solar cells*. Abstract from Annual Meeting of the Danish Physical Society 2016, 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.

Pulsed laser deposition of $\text{Cu}_2\text{ZnSnS}_4$ absorber layers assisted by a reactive sulfur beam for solar cells

J. Ramis¹, S. Canulescu¹, M. L. Traulsen², K. V. Hansen² and J. Schou¹

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

²DTU Energy, Technical University of Denmark, DK-4000 Roskilde

Thin film solar cells based on the p-type semiconductor $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) have emerged as an alternative to CdTe and CuGaInSe_2 (CIGS), the two leading commercial thin film solar absorber materials, due to the low-cost, earth-abundance and non-toxicity together with the high absorption coefficient and an optimal bandgap of 1.45 eV.

By using pulsed laser deposition (PLD), a technique suitable for depositing high-quality films with complex stoichiometry, a metallic target of Cu_2ZnSn was ablated in vacuum onto a substrate. A reactive sulfur beam, which enhances the chemical reactivity of sulfur, is directed towards the substrate in order to reduce the loss of the volatile element S in the deposited film. By this approach, the subsequent annealing in toxic gases (e.g. H_2S) is avoided. All films are deposited onto Mo coated soda-lime-glasses in the temperature range from 150 °C to 550 °C. The excimer laser used is working at 248 nm with a pulse length of 20 ns. The pulse repetition rate is set at 15 Hz and the deposition process is lasting 80 min. For the characterization of the films, Raman spectroscopy, scanning electron microscopy (SEM) and X-ray spectroscopy (EDX) are used.

The Raman spectra show an increase of the intensity and a sharpness of main peak associated to kesterite CZTS up to a substrate temperature of 450 °C. Above the deposition temperature of 450 °C the film decomposes into multiple secondary phases. EDX analyses depict the optimal composition for solar cells in all the samples below 450 °C and SEM demonstrates the dependence of the grain size on temperature.