Universität Oldenburg
Institut für Physik
Abteilung Energie- und
Halbleiterforschung

The research field of the Laboratory for Chalcogenide Photovoltaics (LCP) of the department of Energy and Semiconductor Research (EHF) of the Institute of Physics at the Carl-von-Ossietzky University of Oldenburg offers a master thesis for students of the subjects physics and engineering physics with the title

Development and calibration of an optical simulation for thin-film solar cells.

In recent years, the photovoltaic has become a substantial part of the energy supply by renewable energies. Further research effort in this field is necessary to let photovoltaic remain economical attractive. Thin-film solar cells on basis of Cu(In,Ga)Se2 offer a high capability of improvement. To gain a deeper understanding of the charge carrier generation, optical simulations are widely used. With the help of these simulations, statements about various loss mechanisms are possible. A major challenge is the correct measurement of the input parameters, especially the optical properties of each layer, and to describe scatter and interference effects realistically. Furthermore, there are process induced inhomogeneities of the layers which have to be considered.

Tasks:

Within the scope of this thesis the input parameters for the simulation shall be determined experimentally. Afterwards, the solar cell has to be modeled in 3D and the interaction with sunlight shall be simulated to gain the local charge carrier generation. A TCAD software is used for this purpose which is capable of solving the specific Maxwell-equations multidimensionally with the help of the finite difference time domain method (FDTD). The learning of this software will be an important part of the work. Diverse measurement at the solar cell shall be used to calibrate the developed software model. By this means, it should be possible to provide quantitative evidence of the loss mechanisms at different variations of properties of the solar cell. A further goal is the evaluation of the simulation in comparison with other solver methods (Lambert-Beer, Transfer-matrix method, etc.).

You should be interested in optics and photovoltaics and as well as in the combination of experimental and practical work. Experiences in simulation and/or programming are helpful.

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