I. Physikalisches Institut (IA)
Physik neuer Materialien

RWTH AACHEN UNIVERSITY

AIST

I. Institute of Physics (IA)
Nanocharacterization for advanced functional materials
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Topic for a Master's Thesis

„monocrystaline $Cu(In,Ga)Se_2$ absorber for thin-film solar cells applications"

INTRODUCTION…

In recent years, photovoltaics has developed into one of the premier technologies for sustainable electric power production. There are essentially three major thin-film solar cell technologies, namely amorphous Si, CdTe and $Cu(In,Ga)Se_2$ (CIGS). While efficiencies of these thin-film solar cells are still inferior compared to record monocrystalline Si solar cells, CIGS and CdTe thin-film laboratory solar cells have outperformed multicrystalline Si solar cells recently. The record efficiencies are ~22.6% for CIGS and ~22.1% for CdTe solar cells. Therefore, CIGS and CdTe are very promising PV materials and potential prospective candidates to replace other PV technologies in the market.

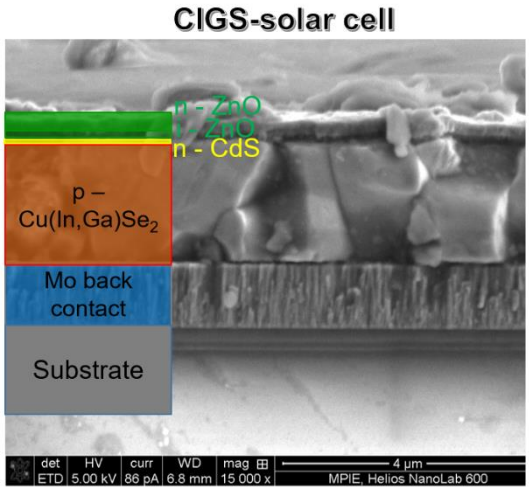

Figure 1: SEM micrograph and schematic of the layer sequence of CIGS solar cells.

A major step forward in this direction would be the fabrication of CIGS solar cell using a monocrystalline CIGS absorber. The advantage by using this layer grown by epitaxy is the **considerably reduction of the fraction of structural defects (grain boundaries, dislocations, stacking faults, etc.) which can have a drastic impact on the cell efficiency**.

This work is in collaboration with AIST (Japan) who can provide high efficient CIGS cells (> 20%, close to record values worldwide). **Thus, the goal of this master topic is to characterize the CIGS absorber layer, obtained under different experimental conditions, using mainly atom probe tomography technique, an outstanding tool which allows to investigate the material in 3D down to near atomic level.**

If successful, this research work will be concretized in a high-impact research publication (no research work was done up-to-date on APT and monocrystalline CIGS absorber layer). Moreover, this work will be greatly appreciated not only by the worldwide PV community, but also by the industry.

THESIS DETAILS…In this Master thesis, we will focus on **the characterization of $Cu(In,Ga)Se_2$ absorbers by atom probe tomography.** A very important aspect is the elemental and impurity composition of various absorber layers deposited at different experimental conditions. Even more important aspect is the Na and K impurity redistribution in the grown absorber layer and the impact on the cell efficiency. The atom probe tomography and all the characterization techniques necessary to obtain a successful Master thesis are available at I. Institut of Physics, RWTH Aachen University.

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