I. Physikalisches Institut (IA)
Physik neuer Materialien

RWTH AACHEN UNIVERSITY

Bundesministerium für Wirtschaft und Technologie

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

„Sputter deposited $CuInSe_2$ absorber layer 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 [1] and 22.1% for CdTe [2] solar cells. Therefore, CIGS and CdTe are very promising PV materials and potential prospective candidates to replace other PV technologies in the market.

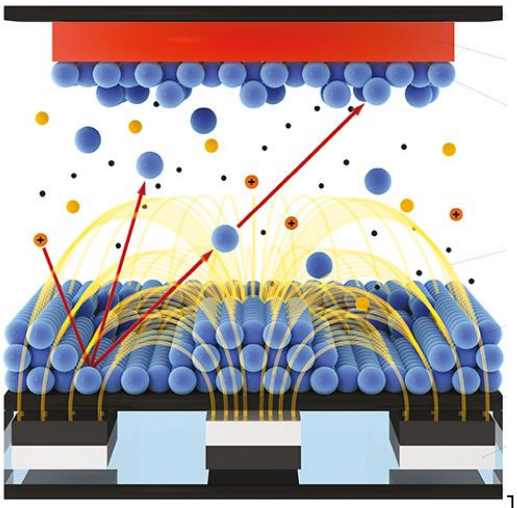

Figure 1: Deposition of CIGS thin-film by sputtering.

A major step in this direction would be the realization of a low-cost, low-temperature fabrication technology based entirely on sputter-deposition processes. For example, CIGS solar cells is composed by the Mo-coated soda-lime glass substrate, CIGS absorber layer, In_2S_3 buffer layer, and ZnO:Al window layers. Except for CIGS, all layers were successfully deposited by magnetron sputtering in the group. **Thus, the goal of this master topic is to continue further with the absorber layer deposition by sputtering** (see Figure 1) **and hence to obtained a full sputter-deposited device.** If successful, this know-how will be greatly appreciated not only by the worldwide PV community, but also by the industry. This work is done within a big framework called EFFCIS II and financed by BMWi. Collaborations with 7 other big project partners from famous PV institutions in Germany is also expected.

THESIS DETAILS…In this Master thesis, we will focus on **the deposition of $CuInSe_2$ and $Cu(In,Ga)Se_2$ absorbers by magnetron sputtering.** A very important aspect is the microstructure (texturing and grain structure) achieved at different elevated temperatures (400-600°C). Even more important aspect is the Na impurity redistribution in the sputtered absorber layer and the impact on the cell efficiency. The sputter tool and all the characterization techniques necessary to obtain a successful Master thesis are available at I. Institut of Physics, RWTH Aachen University.

References:

1 Philip Jackson, Roland Wuerz, Dimitrios Hariskos, Erwin Lotter, Wolfram Witte, and Michael Powalla, Physica Status Solidi **10** (8) (2016).

2 Eric Wesoff, edited by Greentech Media (2016).

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