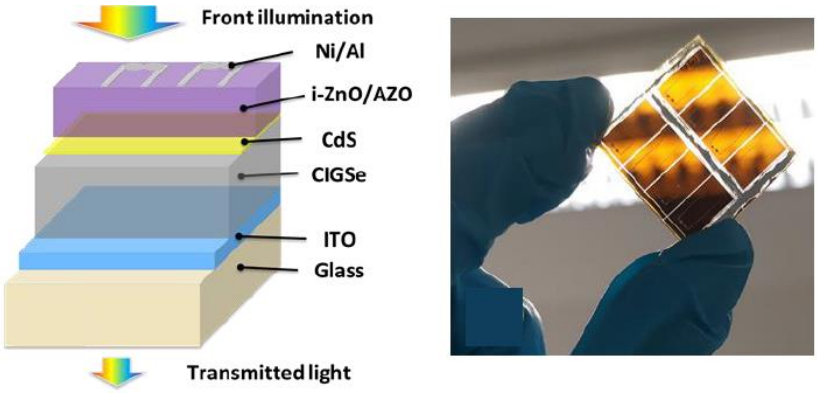
Material-efficient chalcopyrite solar cells for semitransparent applications



Bifacial semitransparent ultra-thin Cu(In,Ga)Se_2 solar cell [PhD thesis Yong Li, University of Duisburg-Essen 2023]

The field of photovoltaic applications is continuously increasing along with the aim of integration into various landscapes like water, cropland, or buildings. In this regard as well as for efficiency enhancement, semitransparent devices play a central role be it for tandem, bifacial, or immediate transparent usage. The presentation focuses on semitransparent solar cells made from chalcopyrites, a highly stable and tolerant material system that allows for advanced device concepts with low material consumption. The optimization of these devices has to consider structural and electrical effects that are closely linked. Furthermore, optical concepts for the most efficient light absorption are explored, which are also closely interrelated with effective carrier collection. The two concepts of bifacial semitransparent ultra-thin and micro-concentrator Cu(In,Ga)Se_2 solar cells will be presented. Both, experimental investigations as well as numerical simulations will be shown to shed light on the devices' performance and potential optimization. In this way, we aim to make chalcopyrite solar cells ready for a broad field of applications and for the next generation of photovoltaics which has the potential to surpass Shockley-Queisser's single-cell efficiency limit.

Martina Schmid is a Professor of Experimental Physics at the University of Duisburg-Essen, Germany, since 2017. Before, she was a Junior Professor at the Freie University Berlin (FUB) and Head of a Helmholtz Young Investigator Group at the Helmholtz-Zentrum Berlin (since 2013/2012). She pursued postdoctoral research at the California Institute of Technology (USA) and the University of Ljubljana (Slovenia). During her Ph.D., which she obtained from FUB in 2010, she also spent a research stay at the University of New South Wales (Australia). Her major research interest is resource-efficient energy conversion including multi-optical concepts for tailored light guiding and concentration.