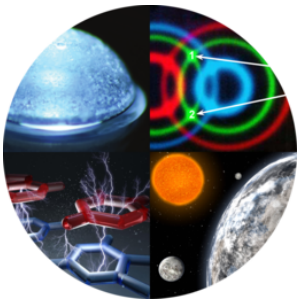

Münchner Physik-Kolloquium

at home! Winter 2021/22

Highly efficient monolithic tandem solar cells with metal-halide perovskites

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Monday, 13 December 2021, 17:15 h
https://tum-conf.zoom.us/j/93234766313 Meeting-ID: 932 3476 6313 Password: Kolloquium
Please install the software in advance.

Integrating metal halide perovskite top cells with crystalline silicon or CIGS bottom cells into monolithic tandem devices has recently attracted increased attention due to the high efficiency potential of these cell architectures. To further increase the performance of these fascinating tandem solar cells to a level of predicted efficiency limits well above 30optimizations as well as a detailed device understanding of this advanced tandem architecture need to be developed. Here we present our recent results on monolithic tandem combinations of perovskite with crystalline silicon and CIGS, as well as tandem relevant aspects of perovskite single junction solar cells.

Recently we have shown that self-assembled monolayers (SAM) could be implemented as appropriate hole selective contacts. The implementation of new generation SAM molecules enabled further reduction of non-radiative recombination losses with Voc's up to 1.19 V and efficiency of 21.2% for p-i-n perovskite single junctions with band gaps of 1.63 eV and 1.55 eV, respectively. By fine-tuning the SAM molecular structure even further, the photostability of perovskite composition with tandem-ideal band gaps of 1.68 eV could be enhanced by reduction of defect density and fast hole extraction. That enabled a certified world record perovskite/silicon tandem solar cell efficiency at 29.15%.

In addition to the experimental material and device development, also main scientific and technological challenges and empirical efficiency limits as well as advanced analysis methods will be discussed for perovskite based tandem solar cells. In addition, first results for upscaling of these industrial relevant tandem solar cells by thermal evaporation and slot-die coating will be shown.