

Perovskite Tandem Solar Cells

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ABSTRACT

In this presentation I will discuss the multiple ways how monolithic perovskite/silicon tandem solar cells, built from textured silicon heterojunction solar cells, with high performance can be fabricated. For the perovskite deposition on such micron-scale, complex surfaces, adequate methods include hybrid deposition (via a 2-step combination of evaporation and solution processing), and solution-processing, resulting either in conformal or non-conformal perovskite films, respectively. Generally, key to successful tandem devices is the absence of pinholes in the perovskite films, which otherwise would lead to device shunting. For the solution-processed perovskites, this mandates the deposition of relatively thick perovskites [1]. However, efficient charge-collection from such perovskites requires adequate defect passivation, for example via passivation of the NiO_x/perovskite interface with dyes [2], as well as concurrent cationic and anionic defect passivation strategies via molecules such as phenformin [3] or carbazole [4]. Overall, this resulted in certified power conversion efficiencies > 28.2%.

Next, with the developed high-efficiency tandems, I will discuss their outdoor performance, with specific attention to the impact of the operational temperature on current matching [5], as well as general reliability aspects. I will conclude my talk with arguing how bifacial perovskite/silicon tandems aid further improving device performance and stability, thanks to their reliance on narrow-bandgap perovskites for optimal performance.

BIO

Stefaan De Wolf received his Ph.D. degree in 2005 from the Katholieke Universiteit Leuven in Belgium, during which time he was also affiliated with imec in Belgium, working on crystalline silicon solar cells. From 2005 to 2008, he was with the National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan. In 2008, he joined the Photovoltaics and Thin-Film Electronics Laboratory, Ecole Polytechnique Federale de Lausanne (EPFL), Neuchatel, Switzerland, as a team leader working on high-efficiency solar cells. Since September 2016 he is an associate professor at the King Abdullah University of Science and Technology (KAUST) in Saudi Arabia, working on high-efficiency silicon and perovskite solar cells, and combinations thereof.

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