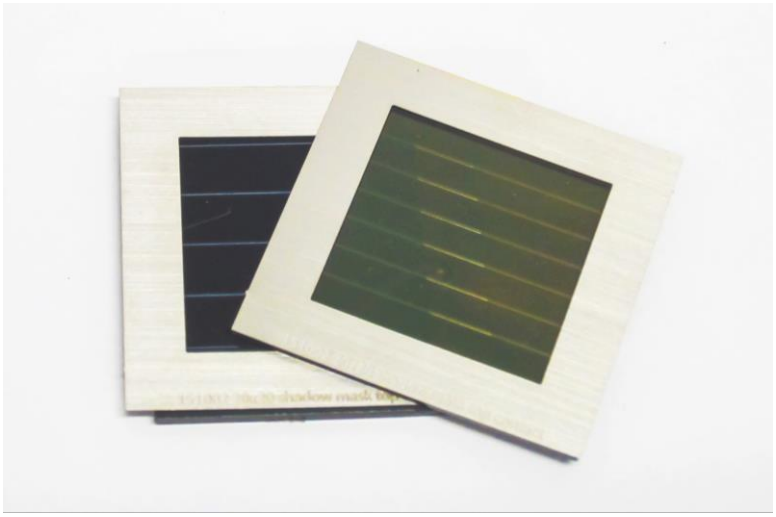
Record for Perovskite/CIGS Tandem Solar Module

Prototype of a Perovskite/CIGS Tandem Thin-Film Solar Module Achieves an Efficiency of 17.8 Percent / First-Ever to Surpass the Efficiency of Single Perovskite and CIGS Solar Modules



Prototype tandem solar module made up of a semitransparent perovskite solar module (on top) and a CIGS solar module (below). (Picture: imec/ZSW/KIT)

Thin-film technologies can dramatically reduce the cost of next-generation solar modules. Whereas their production cost is low, it is in particular the combination of complementary absorber materials in a tandem solar module that increases the power conversion efficiency. At the PSCO international conference in Genova, researchers from KIT, ZSW, and the Belgian research institute imec present a perovskite/CIGS tandem thin-film solar module that achieves 17.8 percent in efficiency, surpassing for the first time the efficiency of separate perovskite and CIGS solar modules.

“Our prototype demonstrates that scalable perovskite/CIGS solar modules can drastically surpass the efficiency of a separate solar module made of these materials,” emphasizes Dr. Ulrich W. Paetzold of KIT. His newly established young investigators group at KIT’s Institute of Microstructure Technology and Institute of Light Technology investigates and optimizes light trapping and energy efficiency in these tandem solar modules.

Professor Michael Powalla, head of the Thin-film Photovoltaics Division at KIT as well as member of the board and head of the Photovoltaics Division at ZSW, points out: “The novel stacked module is

KIT Energy Center: Having future in mind

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an elegant way of making optimum use of a large part of the solar spectrum by combining the advantages of two highly innovative thin-film technologies." Whereas the semitransparent upper perovskite solar module efficiently absorbs the high-energy portion of the solar spectrum, the lower CIGS (Copper Indium Gallium Selenide) layer converts the infrared parts. In total, the prototype achieves an energy conversion efficiency of 17.8 percent. For comparison, the current world record for perovskite modules on this scale is at 15.3 percent, and the reference CIGS solar module has an efficiency of 15.7 percent.

Besides, the stacked module implements a fully scalable device concept that matches industrial needs. Both, the perovskite top module and the CIGS bottom module feature an aperture area of 3.67 square centimeter and a monolithic interconnection scheme, using 4 and 7 module cell stripes respectively. The area losses are less than 8 percent for both technologies and the interconnection can be laser-processed, allowing industrial scaling to stacked modules of several square meters. All previous reports on this technology have been limited to very small scale solar cells. The presented achievement takes the technology to large area and scalable solar module architecture which show remarkable power conversion efficiencies.

Tom Aernouts, team leader head of thin-film PV research at imec commented: "This result was made possible by combining the complementary world-leading expertise of the three partners in a very fruitful collaboration." Whereas the Belgian research institute imec is a leader in the manufacture of semitransparent perovskite solar modules, ZSW is a pioneer in the development and scaling of CIGS-based solar cells and modules and holds the efficiency world record of 22.6 percent for CIGS thin-film solar cells which are the basic elements for interconnected solar modules. The Helmholtz Young Investigators Group at KIT, headed by Dr. Ulrich W. Paetzold, studies the optics in these components and develops new nanophotonic materials for improved light harvesting.

Read more about nanophotonics at KIT:
https://www.imt.kit.edu/1291.php

More about Nanotechnology at KIT:
https://www.stn.kit.edu/

About ZSW

ZSW (Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg - Center for Solar Energy and Hydrogen Research Baden-Württemberg) is one of the leading institutes for

applied research in the areas of photovoltaics, renewable fuels, battery technology, fuel cells, and energy system analysis. There are currently around 230 scientists, engineers, and technicians employed at ZSW's three locations in Stuttgart, Ulm, and Widderstall. In addition, there are 90 research and student assistants. Read more: www.zsw-bw.de

About imec

Imec performs world-leading research in nanoelectronics and photovoltaics leveraging its scientific knowledge with the innovative resources of its global partnerships in ICT, healthcare, and energy. Imec delivers industry-relevant technology solutions. In a unique high-tech environment, its international top talent is committed to providing the building blocks for a better life in a sustainable society. Imec is headquartered in Leuven, Belgium, and has offices in Belgium, the Netherlands, Taiwan, USA, China, and Japan. Its staff of about 2,500 people includes about 740 guest researchers. The imec budget is 415 million euros. Imec is a partner in Solliance (www.solliance.eu) and EnergyVille (www.energyville.be). Read more: www.imec.be

More about the KIT Energy Center: http://www.energy.kit.edu

Karlsruhe Institute of Technology (KIT) pools its three core tasks of research, higher education, and innovation in a mission. With about 9,300 employees and 25,000 students, KIT is one of the big institutions of research and higher education in natural sciences and engineering in Europe.

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