PRESS RELEASE

Back-contact heterojunction solar cell by HZB and ISFH achieves record efficiency

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Independent testing lab confirms 20.2 percent

A novel type of solar cell called a "back-contact heterojunction solar cell" has achieved an enormous jump in efficiency. While values published in 2011 hovered around 15 to 16 percent, an advanced development has now reached 20.2 percent efficiency. It was developed at the Institute for Silicon Photovoltaics (E-I1) of Helmholtz Zentrum Berlin (HZB) in collaboration with the Institute for Solar Energy Research Hameln (ISFH) in a project funded by the Federal Ministry for the Environment and the companies Bosch, Schott Solar, Sunways and Stiebel Eltron. This record was measured at an independent calibration laboratory at the Fraunhofer Institute for Solar Energy Systems (ISE) in Freiburg im Breisgau, Germany.

Back-contact heterojunction solar cells unify two different photovoltaic technologies and their advantages: back contacts and silicon heterojunctions. In back-contact solar cells, the metal fingers that collect the electricity produced in sunlight rest on the reverse side of the cell. This avoids shadowing and allows wide, low-resistance contact fingers to be used. Heterojunction technology is where two semiconductors with different band gaps are used together in a solar cell. In the present case, these are crystalline and amorphous silicon, which results in high efficiency on its own. "Both methods have the advantage of already being used in industry," says HZB institute director Prof. Dr. Bernd Rech. "By combining both concepts, it should be possible to reach very high efficiencies of up to 25 percent. If so, we could significantly reduce the price per Watt produced. Our proof-of-concept study has now taken us a big step forward. What we need to do now is increase the efficiency even further and develop the simplest possible manufacturing process."

The first publications on silicon-based heterojunction solar cells date back to 2007, as do publications from the HZB institute (Stangl et al.). The published efficiencies of these cells were typically in the range of 15 to 16 percent up until 2011. At the end of 2011, at the European Photovoltaics Conference, solar cell manufacturer LG reported an efficiency of greater than around 22 percent, although this had not yet been confirmed by an independent party. In the spring of 2011, a small-area laboratory cell was produced with an efficiency of 20.2 percent (Mingirulli et al. pss rrl, March 2011). The back-contact heterojunction solar cell developed by HZB and ISFH in their "Top-Shot" project has now been measured by the calibration laboratory ISE CalLab, and has reached the highest independently confirmed efficiency of this type of solar cell. "If experts from different fields work well together, that accelerates the development considerably," Prof. Dr. Nils- Peter Harder of ISFH declares.

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Comb-shaped, interdigitated metal contacts on the side facing away from the sun of back-contact silicon heterojunction solar cells. Pictured are several test cells on a single silicon wafer.
Image source: HZB

Helmholtz Zentrum Berlin für Materialien und Energie (HZB) operates and develops large-scale facilities for research using photons (synchrotron radiation) and neutrons, with internationally competitive and in some cases unique experimental opportunities. These experimental stations are used by more than 2500 guests each year from universities and non-university research institutes around the world. Helmholtz Zentrum Berlin conducts materials research on topics that place high demands on these large-scale facilities. These topics are materials research for energy technologies, magnetic materials and functional materials. In solar cell research, focus is on developing thin-film solar cells, yet another important research topic is chemical fuels from sunlight. HZB has around 1100 employees, of which 800 are on the Lise-Meitner campus in Wannsee and 300 on the Wilhelm-Conrad-Röntgen campus in Adlershof.

HZB is a member of the Helmholtz Association of German Research Centres (Helmholtz-Gemeinschaft Deutscher Forschungszentren e.V.), the largest scientific organization in Germany.

The **Institute for Solar Research Hameln (ISFH)** conducts pure and applied research into photovoltaics and solar thermal energy. Their fields include materials research, optical and electronic characterization of solar cells, development of novel solar cells and industrial solar cell development in mock production plants, computer simulation of solar cells and optical components, PV module development and characterization, and long-term reliability tests of PV modules. Solar thermal research ranges from absorber and collector development, to storage technology, to system analysis and certification of solar collectors. ISFH acts as a link between pure research and applied development for research partners of manufacturers, system builders and users of photovoltaic and solar thermal systems.

ISFH is an institute in Lower Saxony and is attached to Gottfried Wilhelm Leibniz Universität Hannover.

The **TopShot project** is financially supported by the Federal Ministry for the Environment as well as the four industrial partners Schott Solar, Bosch, Sunways and Stiebel Eltron.