PRESS RELEASE

Fraunhofer ISE Achieves Record Efficiencies for Tandem Photovoltaic Modules

Scientists at the Fraunhofer Institute for Solar Energy Systems ISE have succeeded in constructing two tandem photovoltaic modules with record efficiencies. A III-V germanium PV module with an efficiency of 34.2 percent, incorporating solar cells from AZUR SPACE and anti-reflection structures from temicon, thus becomes the most efficient solar module in the world. A III-V silicon PV module achieves an efficiency of 31.3 percent, setting a record in its class, and is based on established, cost-effective silicon technology.

“Both tandem PV technologies have the potential to fill application gaps between conventional, cost-effective ground-mounted and rooftop systems on the one hand, and high-performance but more expensive space solar cells on the other,” says Prof. Dr. Andreas Bett, Director of Fraunhofer ISE. “III-V in tandem with silicon as a more affordable option, III-V on germanium as a slightly more efficient alternative, are both interesting technology routes for integrated PV applications wherever space is limited.”

A few years ago, researchers at the Fraunhofer ISE achieved a new efficiency record for silicon-based solar cells with a III-V silicon solar cell reaching 36.1 percent. As part of the research project "Mod30plus," they have now, for the first time, realized a small-scale production of these solar cells, adapted for interconnection with shingle technologies. A module produced by the research team in this way, measuring 218 square centimeters, has now achieved a record efficiency of 31.3 percent.

A 833-square-centimeter tandem module with an efficiency of 34.2 percent was built by a second research team from Fraunhofer ISE as part of the "Vorfahrt" project. It consists of triple III-V germanium cells, which the project coordinator AZUR SPACE Solar Power further developed for the new module technology. For this purpose, the solar cell manufacturer adapted its triple solar cell technology to the terrestrial solar spectrum, so that it can now be produced in comparable quantities and in the same wafer formats as space solar cells. temicon GmbH further improved the module's efficiency through a stochastic surface structure transferred onto the glass surface using nanoimprint, which minimizes reflection losses at this interface of the record module.

Conventional silicon solar cells cannot exceed a physical efficiency limit of 29.4 percent; currently commercially available PV modules already have efficiencies around 24 percent. "That is why we are conducting intensive research to replace single solar cells

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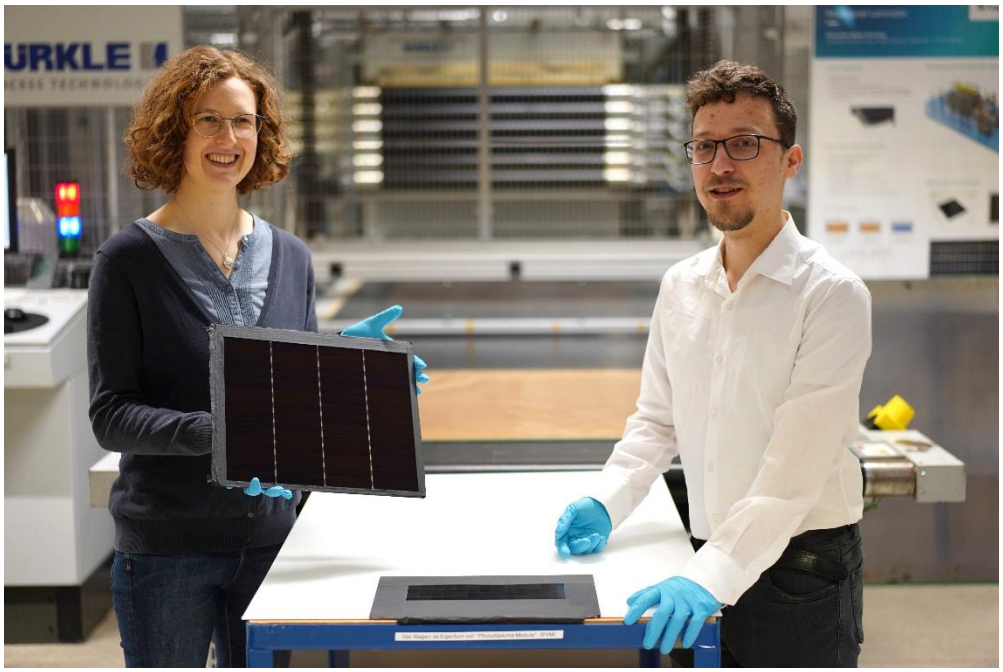
with multiple solar cells in modules," says Dr. Laura Stevens, scientist at Fraunhofer ISE and project leader in Vorfahrt. "The fact that we achieved a world record with the III-V germanium module shows the great potential in combining multiple semiconductors." "Tandem photovoltaics is one of the fastest-growing research fields in solar research today," adds Dr. Jonas De Rose, project leader in Mod30plus.

Numerous cooperation partners were involved in the further development of the III-V silicon solar cell into a module: III/V-Reclaim, AZUR SPACE Solar Power GmbH, ICB GmbH & Co. KG, Karlsruhe Institute of Technology (KIT), LPKF Laser & Electronics SE, PROTAVIC INTERNATIONAL, as well as SUNSET Energietechnik GmbH. In addition to AZUR SPACE Solar Power GmbH and temicon GmbH, the III-V-on-germanium world record module also involved GOCHERMANN SOLAR TECHNOLOGY Ltd. & Co. KG, Audi AG, and Elektra Solar GmbH. Both research projects were funded by the German Federal Ministry for Economic Affairs and Energy.



Project manager Dr. Laura Stevens is showing one of the III-V germanium PV modules with a record efficiency of 34.2 percent. Leonhard Böck is a member of the project team and played a key role in developing the III-V silicon PV module with 31.3 percent efficiency that lies in front of him.
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