

Press Release

Tandem Solar Cells

Fraunhofer ISE Opens Laboratory to Accelerate Market Introduction of Perovskite-Silicon Photovoltaics

By applying a perovskite cell just 500 nanometers thick onto a conventional silicon solar cell, the theoretical efficiency limit increases from 29.4 to 43.3 percent. To pave the way for the industrial implementation of this tandem technology, the Fraunhofer Institute for Solar Energy Systems ISE opened a new laboratory today. The “Pero-Si-SCALE” offers an independent R&D infrastructure and is available to the German and European photovoltaic industry. In particular, solar cell and module manufacturers can use it to scale up new cell designs to large cell formats using industry-standard manufacturing processes, analyze them extensively, and integrate them into PV modules.

“Photovoltaics is far from being ‘fully researched,’” said Prof. Dr. Stefan Glunz, Head of the Photovoltaics Division at Fraunhofer ISE, at the opening. “On the contrary, there is still a great deal to be gained here, and tandem solar cells are the key to achieving even greater efficiency. This means more solar energy in a smaller area and with less material usage.”

The new [Pero-Si-SCALE](#) builds on developments from the laboratory (Technology Readiness Level TRL1–TRL4) and transfers the innovative cell designs to industrial cell formats—up to a wafer size of 210 by 210 square millimeters—using scalable, high-throughput manufacturing processes. In addition to the development of perovskite-silicon solar cells and modules, as well as technologies for their manufacturing, the Pero-Si-SCALE also offers a comprehensive characterization and analysis environment.

“The new laboratory infrastructure builds on 20 years of experience in industry-oriented development of silicon photovoltaics at the Photovoltaic Technology Evaluation Center (PV-TEC),” explained Priv.-Doz. Dr. Ralf Preu, Head of the Photovoltaics Division at Fraunhofer ISE. “The PV-TEC also ensures the supply of optimized silicon bottom cells to the Pero-Si-SCALE, as well as a close connection to current production processes.”

Fraunhofer ISE focuses on the so-called “hybrid route”—a combination of vacuum and wet chemical processes—for the manufacturing process of perovskite-silicon tandem solar cells.

Using this technology, the institute has already achieved peak efficiencies of over 33 percent on a laboratory scale. This process has the advantage that “standard,” textured silicon solar cells from the industry can still be used. This allows for direct integration with today’s solar cell standards and achieves a higher energy yield from the tandem modules. The successful combination of a wide variety of thin-film deposition technologies with wafer-based silicon technology is the challenge for efficient industrial implementation.

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“Perovskite-silicon photovoltaics offer the machine manufacturing sector the opportunity to achieve a leading global position in high-throughput systems,” said Pia von Ardenne, managing director of VON ARDENNE GmbH. “I am delighted that our vacuum coating systems at Fraunhofer ISE are contributing to industry-oriented research at the highest level. This will enable us to jointly tap into scalable markets through industrial-scale coating processes for the new generation of solar technology.”

“Perovskite-silicon tandem solar cells offer an opportunity for a (re)entry into European industrial PV manufacturing,” added Prof. Dr. Andreas Bett, institute director of Fraunhofer ISE. The German and European solar manufacturing industry is at risk to lose further market share. “In photovoltaic research, we are at the international cutting edge, also thanks to funding from the German Federal Ministry for Economic Affairs and Energy (BMWE), and this can and should bolster our local industry partners.”



Fig.1 To pave the way for the industrial implementation of tandem solar cells, Fraunhofer ISE has opened a new laboratory. © Fraunhofer ISE / Photo: Michael Spiegelhalter



Fig. 2 Pero-Si-SCALE transfers cell designs from the laboratory to industrial cell formats up to a wafer size of 210 by 210 square millimeters. © Fraunhofer ISE / Photo: Michael Spiegelhalter



Fig. 3 For the manufacturing process of perovskite-silicon tandem solar cells, Fraunhofer ISE focuses on the so-called “hybrid route,” a combination of vacuum and wet chemical processes. © Fraunhofer ISE / Photo: Michael Spiegelhalter

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