Press Release

Building-Integrated Photovoltaics

Colored films enable patterns on PV modules

Scientists at the Fraunhofer Institute for Solar Energy Systems ISE have succeeded in creating colored films with transparent cutouts, thereby producing realistic-looking designs on photovoltaic modules. In this way, roof tiles, for example, can be imitated. The film cutout patterns utilize MorphoColor® technology, an invention of Fraunhofer ISE that creates a color impression without significantly impairing the efficiency of a PV module. Visitors to The Smarter E / Intersolar 2026 can view PV modules equipped with "ShadeCut" film cut patterns at the Fraunhofer ISE booth A1.440.

"Through targeted structuring and cutouts on a color-producing film, we can integrate color effects and complex patterns directly into solar modules and facade elements," explains Marco Ernst, developer of the "ShadeCut" technology and a researcher at Fraunhofer ISE. "Additionally, there is the option to add further layers with cutouts to create structures or additional colors."

The technology can be applied to all standard photovoltaic and solar thermal modules; the desired pattern is cut into the films with MorphoColor® coating using laser or CAD-controlled processes.

"The technology is particularly interesting for modules intended for integration into facades, roof-integrated PV, or even railings—especially on historic buildings," says Dr. Martin Heinrich, group leader for encapsulation and integration of photovoltaics at Fraunhofer ISE. "Modules with ShadeCut can look like masonry or roof tiles and blend in perfectly in terms of color. It also allows for the customization of PV systems, for example with logo lettering or patterns."

The MorphoColor® technology for color is inspired by the butterfly of the same name. The 3D photonic structures on the butterfly's wings create an intense and angle-stable color impression through a fundamentally low-loss interference effect. Following this biological model, a research team at Fraunhofer ISE has succeeded in applying a similar surface structure to the back of the cover glass of photovoltaic modules using a vacuum process.

Depending on the microstructure, cover glasses can thus be produced in various colors. Scientists have now also succeeded in applying this to film, either as a flexible

encapsulation film in modules or as a backsheet. Independent measurements confirm that the colored PV modules with MorphoColor® coating deliver approximately 95 percent of the power output of a comparable uncoated module.

Further information:

https://www.ise.fraunhofer.de/en/events-and-trade-fairs/intersolar-europe.html

https://www.ise.fraunhofer.de/en/business-areas/photovoltaics-production-technology-and-transfer/interconnection-and-encapsulation-technologies/encapsulation-technologies.html

https://www.ise.fraunhofer.de/en/business-areas/solar-power-plants-and-integrated-photovoltaics/integrated-photovoltaics/building-integrated-photovoltaics-bipv.html

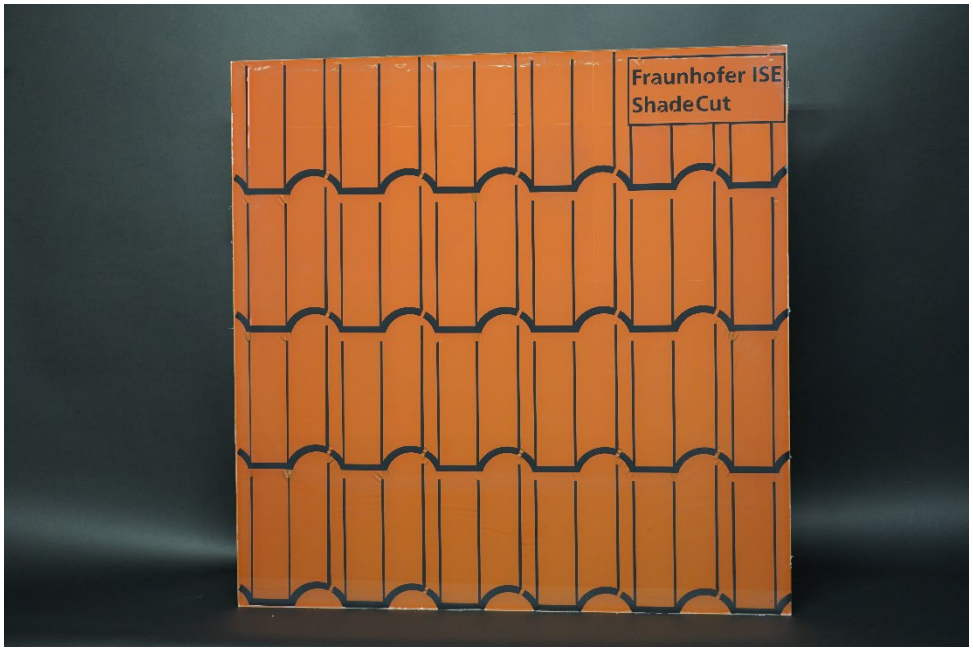

Fig.1 The foil cutting patterns can be used, for example, to imitate roof tiles without significantly impairing the efficiency of the PV module. © Fraunhofer ISE / Photo: Marco Ernst

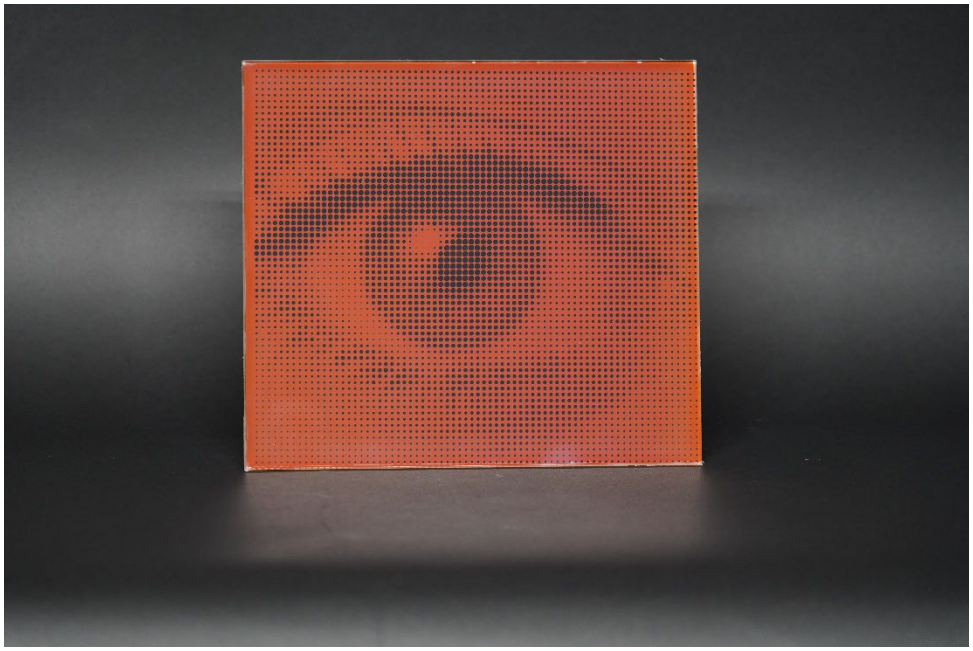

Fig. 2 ShadeCut enables the customization of PV systems, such as with lettering or patterns. © Fraunhofer ISE / Photo: Marco Ernst

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