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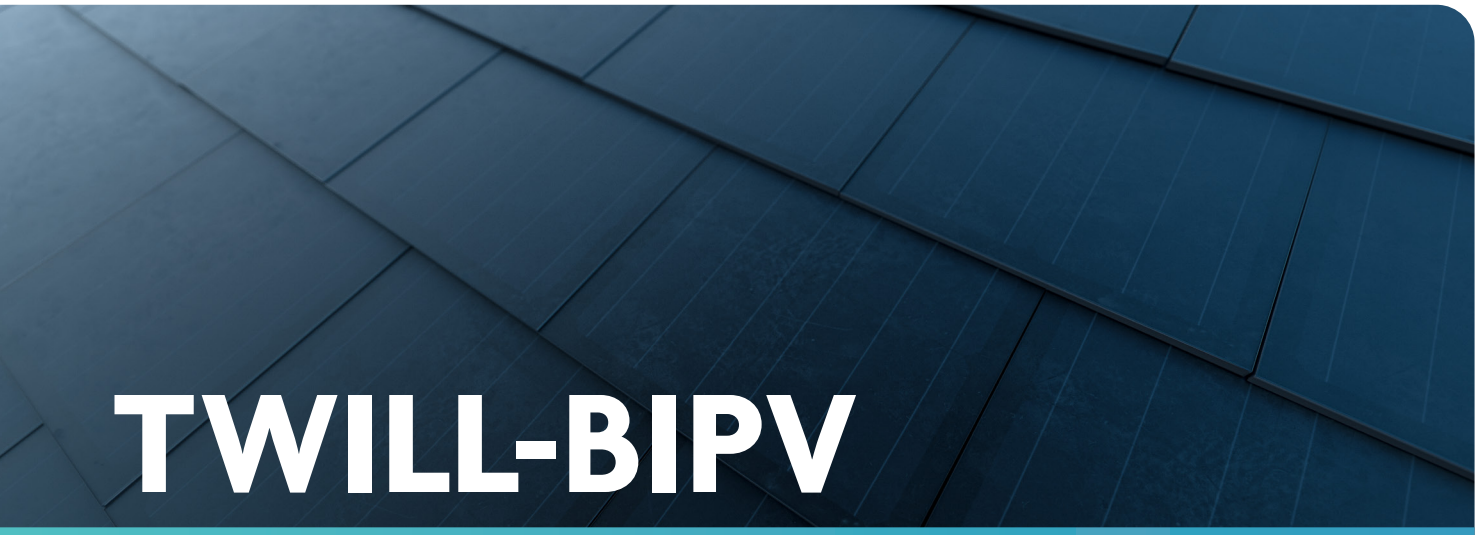
An imec.icon research project | project results

SMART INDUSTRIES



TWILL-BIPV

Improving the aesthetics of photovoltaics integrated into buildings

The challenges of climate change call for a massive energy transition towards renewable sources. Photovoltaics (PV) which generate electricity from sunlight have a crucial role to play. But while solar parks are booming worldwide, they do little to meet aesthetic considerations and are difficult to design cost-effectively. Ideally, electricity should be produced close to the consumer, especially in densely populated areas such as northern Europe. This would make it easier to integrate sustainable energy into electrical grids, increase reliability and limit the impact of energy infrastructures on landscapes and cities. Building-integrated photovoltaics (BIPV) offer the potential to enable aesthetically attractive PV installations on buildings while also meeting performance and reliability requirements. In addition, they support the 2018 European Near Zero Energy Building (NZEB) regulation.

The IT WILL Be Integrated Photovoltaic (TWILL-BIPV) project aimed to improve the aesthetics of BIPV modules, and explore low-cost, customizable ways to manufacture these better-looking modules. It focused on module materials, technologies, flexible production processes and equipment to meet BIPV manufacturers' needs. This included simplifying module assembly, as well as reducing capital and operating costs of installations.
A central goal was the creation of an innovative woven multi-wire interconnection and encapsulation technology to improve the appearance of bifacial solar cells, along with the components, tools and processes necessary for its production.

THE OUTCOMES

1. Patented woven cell interconnection technology

The project partners worked closely to develop the patented woven cell interconnection technology concept, which has been shown to meet performance and reliability requirements on the mini PV module level.

The project also created a novel encapsulant formulation and defined a lamination process that together improve module reliability. These have been demonstrated to be compatible with industrial requirements and are the subject of an ongoing additional patent application.

Reliability was a key consideration throughout the project. The project partners conducted failure mode and effect analysis to identify and eliminate risks associated with the new module materials. The project also led to the development of dedicated reliability tests and sample structures to investigate the reliability of low temperature solder joints. Thermal cycling, damp heat tests following the IEC 61215 standard and high temperature building tests were carried out on mini modules with promising results. The next challenge is to confirm these results on larger samples and statistically relevant batch sizes.

2. Full-sized BIPV demonstrators

During the project, variants such as printed and patterned glass suited to the new interconnection technology were developed with the aim of further enhancing module aesthetics. The project partners created two full-sized BIPV demonstrators combining the novel encapsulant, glass, multi-wire interconnection foil and automated module layup, plus the performance- and reliability-validated solder and lamination process:

- a facade element of 80 cm x 80 cm with 4 mm thick glass
- a roof element (Solesia tiles) of 60 cm x 152.4 cm

3. Production tools

The fabrication of these modules was made possible by an on-demand interconnection foil production concept tool designed and created by IPTE. By showing the flexibility of both the interconnection foil and the module assembly process, the project has paved the way for scalable and affordable mass customization of BIPV elements. In addition, pioneering in-line cutting and weaving of soft encapsulants by project partner, VdS Weaving, have proven that high-volume production of the interconnection foil is possible. Several meters of the interconnection foils were manufactured. This enabled detailed cost calculations which will be a valuable guide for further development and interaction with initial potential clients.

NEXT STEPS

Following these promising results, research will continue into the reliability of the interconnection technology, focusing particularly on larger-scale production. Cost competitiveness plus optimization of materials and manufacturing equipment will also be explored. These further research activities aim to address (building and vehicle) integrated PV producers' requirements for output and capital expenditure. The ultimate goal is to prepare the ground for commercial product development of innovative and cost-effective BIPV products. Based on this research, project partner, Soltech plans to integrate the new multi-wire interconnection into its existing products and to create a new product line based on the multi- wire interconnection manufactured in an automated production process.

TWILL - BIPV project partners:

ARKEMA · IPTE EXPERTS IN FACTORY AUTOMATION · SOL TECH · VdS WEAVING INNOVATIVE TECHNICAL FABRICS

FACTS

NAME	**TWILL-BIPV**
OBJECTIVE	Integrated material, assembly and process research for woven solar cell interconnection technology targeted for BIPV application
TECHNOLOGIES USED	Novel photovoltaics cell interconnection technology using woven multi-wire contact foils, low-temperature soldering, advanced weaving and automation technologies, building integrated PV module lamination technology and aesthetic glass coatings
TYPE	imec.icon project
DURATION	01/06/2018 – 31/08/2020
PROJECT LEAD	Stefan Dewallef, Soltech
RESEARCH LEAD	Eszter Voroshazi, imec
BUDGET	1,272,050 euro
PROJECT PARTNERS	VdS Weaving, Soltech, Ipte Factory Automation, Arkema
RESEARCH GROUPS	imec – PV Module & Systems team imec – Electric Assembly group

WHAT IS AN

IMEC.ICON PROJECT?

The imec.icon research program equals demand-driven, cooperative research. The driving force behind imec.icon projects are multidisciplinary teams of imec researchers, industry partners and/or social-profit organizations. Together, they lay the foundation of digital solutions which find their way into the product portfolios of the participating partners.

The TWILL - BIPV project was co-funded by imec, with project support from Agentschap Innoveren & Ondernemen.

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