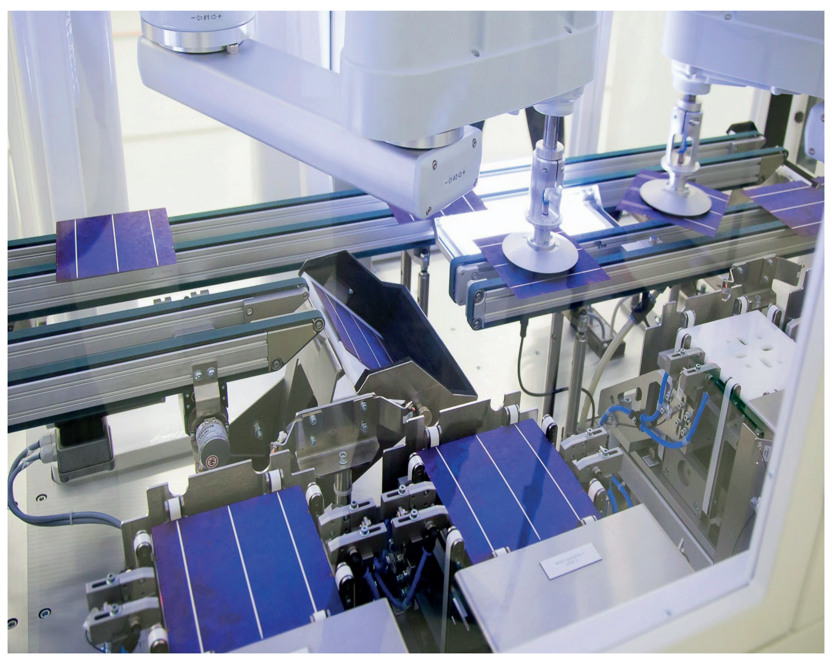
Nanocoatings for Enhanced Performance of PV Systems in SUPER PV Project

Purpose of the Project

Today photovoltaics (PV) has become one of the most cost-effective forms of electricity production globally and in some regions is already the most competitive unsubsidised form of electricity. Despite positive cost and growing developments, European PV manufacturers are facing a decline in production due to competition from third countries. The fragmentation of the value chain compared to competing actors is believed to be the major factor for this decrease in the competitiveness.



SUPER PV is a **collaborative European-funded project** initiated in 2018 by 26 partners in reaction to this trend. Together, they target a significant LCOE reduction (26%-37%) for European-made PV by adopting a hybrid approach combining technological innovations and management methods. Introducing superior quality PV systems will create conditions **for accelerating large scale deployment in Europe and help EU PV business to regain leadership on world market**.

Methodology

Development of technology innovations and novel data management tools → Testing of the innovations and methods in real conditions → Evaluation of the effectiveness of the proposed solutions

Scope of SUPER PV

the project concept tackles in an integral way following three cornerstone steps impacting PV system performance and, thus, LCOE:

Module Level **Power Electronics** (MLPE) developments ensuring higher power output, performance monitoring and data collection on string level, and long term stability of operation.

PV system integration and process innovation, developing a new digital and holistic process: PIM (PV information Modelling/Mgmt.)

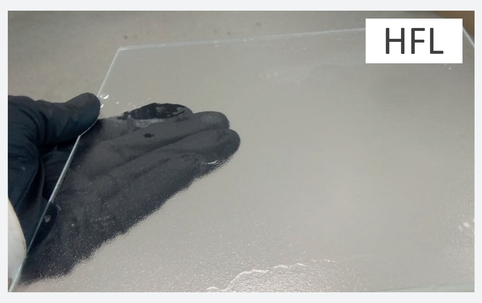
PV module innovations introducing and combining five PV module innovations applied to c-Si based bifacial modules and CIGS modules. One of these innovation at module level is a combination of anti-Soiling, anti-reflection and infrared reflection coating based on nanoparticles to increase the annual yield of the PV modules.

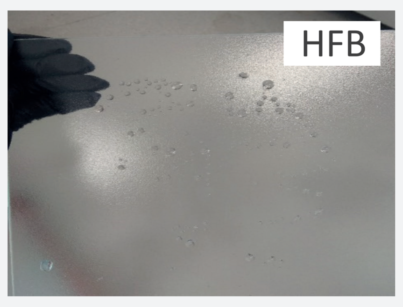
First Results on Anti-Soiling and Anti-reflective Nanocoatings developed within SUPER PV

Effect against Water of Anti-Soiling Nanocoatings on Glass and Plastic Surface

TECNAN/LUREDERRA have carried out the application of two approaches (Hydrophilic (HFL) and hydrophobic (HFB)) on glass samples provided by the industrial partner SOLITEK and on plastic surfaces provided by TNO and FLISOM.

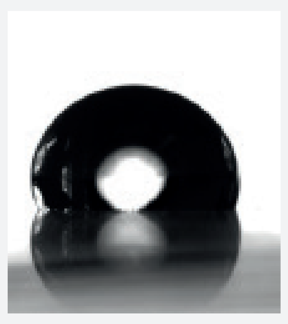
Glass surfaces

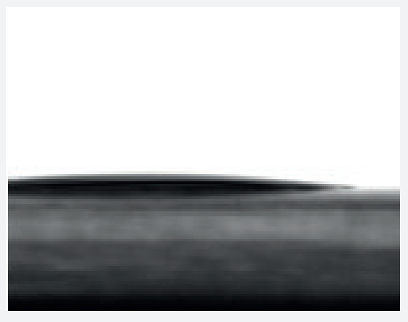




PRODUCT	T_{VIS}	Water Angle Contact
Non-Treated	86-88	20–25 °
Hydrophilic	85-88	15–20 °
Hydrophobic	85-86	105–110 °

As can be seen in the table above, there is no modification in the transmittance of visible light (TVIS), and the water angle contact is a clear clue of the good performance of each formulation.



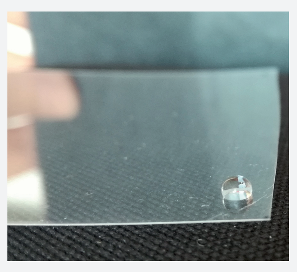


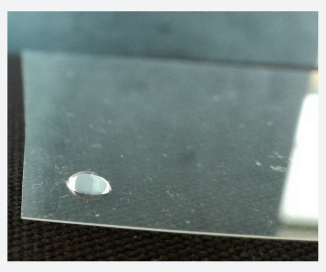
In the pictures on the left it is possible to observe the different water contact angle according to each formulation. The HFB one shows a very clear drop of water meanwhile the HFL approach forms a water film on the glass.

Plastic surface

In the images below we can see TNO samples treated with HFB coating (left) and HFL solution (right). In the middle non-treated sample. We can observe a good effect according to the transmittance of visible light and water contact angle.

PRODUCT	TVIS	Water Angle Contact
Non-Treated	87-88	68,6 °
Hydrophilic	86-87	------ °
Hydrophobic	86	110,1 °





Effect against Powder of Anti-Soiling Nanocoatings on Glass and Plastic Surface

To test the anti-soiling and easy-to-clean properties of the applied approaches, LUREDERRA/TECNAN have tested the behaviour of the coatings in the presence of water and talcum powder.

Glass surfaces

We can observe in the pictures above (non-treated glass on the left and glass with HFL coating on the right) how in the treated sample the talcum powder is completely removed.

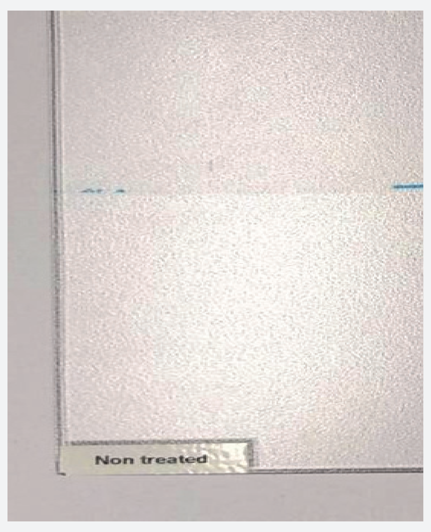
Plastic surface

In the pictures above we can observe the situation before and after of the anti-powder effect on flexible sample treated with HFL approach.

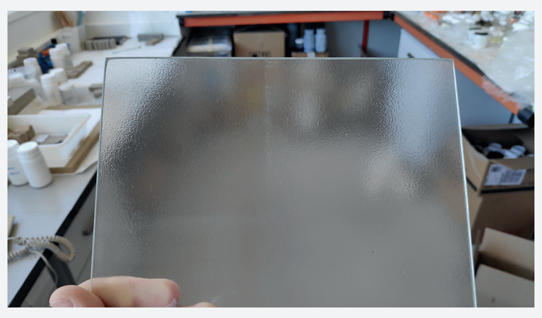
Anti-Reflective Nanocoating Effect on Plastic Surface

First results regarding the anti-reflective coating are showing:

On the one hand, in relation with the reduction of superficial reflections (approach 1), we can see in the picture on the right side how, in the upper part of the glass, the reflection of the light is lower than in the non-treated part.



On the other hand, based on the increment of the transmittance of visible light (approach 2), in the picture on the bottom-left corner we can observe the increase of the transmittance of visible light.



	Transmittance Visible
Non-Treated	86 – 88
Approach 1	86 – 88
Approach 2	91 – 93

With this measurement we can observe according to the table how the approach 1 doesn´t reduce the transmittance of visible light (only the reflection of incident light) and how the approach 2 increases it.

Project Coordinators: SOLITEK & PROTECH
Research Partners on Nanocoatings: TECNAN & Lurederra
To know about other partners in the consortium: *https://www.superpv.eu/partners/*

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