

Diana Yordanova reports on the growing industry involved in the developing and production of thin coatings for photovoltaics that promise to reduce the accumulation of dust and other dirt, thereby enabling the systems to operate more efficiently

Solar power coating innovation drives sales in this important niche market

Co-operation with the paint and coatings sector is enabling innovators within the solar power technology industry to deliver on their promise to be a key means to decarbonise the global economy. Offering a key alternative to dealing with surging fossil fuel energy prices amidst Russia's bloody and destructive invasion of Ukraine, paint and coatings companies are increasingly optimising solar generation. With particular advances in nanotechnology, coating manufacturers, notably those based in Europe or in North America have been developing and selling thin coating layers for photovoltaics (PVs) that promise to reduce the accumulation of dust, sand, salts, ash, and even ice or snow. These allow solar power systems to operate more efficiently. Examples include the USA's Element 119 which offers specifically-designed coatings for solar panels, claiming the coating is invisible and lasts five years, being self-cleaning, repelling water, "carrying dirt with it while cleaning the surface". And Bulgaria's Percenta, which sells a Nano Coating for Solar Panels, a sealant forming a transparent coating that protects cell surfaces from dirt and steam causing blurring or dimming.

■ DUST DETERRENTS

Scientists have long known that dust reduces output power from PVs from between 2% and 50% depending on the amount of grime. A paper released in the academic journal *Renewable and Sustainable Energy Reviews*, called 'Power loss due to soiling on solar panels' published in 2016¹ said: "Dust is generated from many sources such as pollution by wind, pedestrian volcanic eruptions, and vehicular movements among many others. The accumulated dust over time aggravates the soiling effect. In fact, the amount of accumulated dust on the surface of the PV module affects the overall energy delivered from the PV module on a daily, monthly, seasonal and annual basis."



■ SELF-CLEANING SOLAR SHARC

More such paint and coatings products are on their way. UK innovation agency Innovate UK has part-funded Opus Materials Technologies with close to £1M (US\$1.25M) to develop a repellent coating Solar Sharc, using patented technology. This self-cleaning product, on sale since 2021, reduces the accumulation of dirt, is highly repellent, resistant to elevated temperatures, UV resistant, hydrophobic and anti-reflective, enabling the transmittance of more light to panel cells. According to a US Department of Energy note, solar panels with the ability to reflect less sunlight can increase light-to-electricity conversion efficiency and the power output of solar cells by 3% to 6%².

The CEO of Cambridge, England-based Opus Materials Technologies, David Hannan, told *PPCJ* that the "multi-functionalised silica nanoparticles in a siloxane matrix provide a unique combination of repellency and durability needed for a long effective lifetime of modest maintenance for solar PV. The nano-particle structure provides high transparency, improving module efficiency by up to five percent." Apart from delivering better absorption of the sun rays, Solar Sharc also impedes contamination, lowering cleaning costs, manually, through

piped water or air systems, or via robots. And it grows power revenues – the "loss of electricity generation of three to four percent reduces global revenue generation by €3bn to €5bn," Hannan added. Indeed, he believes that mitigating losses in solar panels' energy generation through soiling will become decisive for PV adoption.

Solar Sharc also benefited from a European Union (EU)-funded Horizon 2020 project of the same name, with this budget exceeding €2.8M³, with one research benefit being the development of methods to test the efficacy of solar panel coatings. Here, project participant the French National Solar Energy Institute (INES - Institut National de l'Énergie Solaire) tested the coating's impact on cells so that they comply with International Electrotechnical Commission standard IEC 61215-1:2021 on requirements for the design qualification of terrestrial photovoltaic modules suitable for long-term operation in open-air climates⁴.

American coatings innovators have also made progress. US parent company Nanopower International has been selling titanium dioxide-based coatings into the American market, on claims that these protective products last 20 years on a solar panel, after a single application. Dapo Riches, Marketing Manager at its British distributor NanoTreat says however, that sales can be impeded by the inadequate

quality of competitors delivering inferior products in the past that have damaged the reputation of the industry. "However, our observation is, once the customer actually sees the finished job, they are usually amazed about the quality of the job," he said.

Regulatory certification is a challenge, he said. "Our proprietary TiO₂ Coating offers more than 10 benefits, however, having these claims certified by recognised bodies costs money, and so, we usually have to seek the services of third-party engineers for certification, and this has its pros and cons," he told *PPCJ*. His company has worked with expert testing companies such as Technischer Überwachungsverein (TUV), which works in Germany and Austria, for example.

Riches thinks the market will soften as prices fall, and he is convinced that PV cell coatings will be becoming more affordable, especially if panels are coated before installment. However, even at the current prices, the benefits outweigh the costs, he argued.

Hannan agrees, noting that Solar Sharc sales are now picking up well. Yet, "the full adoption of any new technology takes time as the market assesses the potential

commercial impact of its use and return on investment," he stressed. So, raising awareness about the benefits of PV module coatings, understanding their features, testing, and evaluation is critical to advance deployment. As a result, his company offers customers worldwide the opportunity to undertake field trials of Solar Sharc before scaling up application of the coating.

In Europe, more companies are gearing up to enter the market. Last year, Dutch multinational health, nutrition, and materials corporation DSM sold its resins and coatings business, solar panel products, to Germany's Covestro AG for €1.6bn. Covestro is now marketing an anti-reflection coating XT for "extreme transmission" that the company claims boosts solar cell power output by 10% more than a regular coating that it says already delivers 3% in output gains.

■ OTHER RENEWABLE ENERGY USES

Looking ahead, Hannan predicted that solar power coatings technologies could be leveraged for other renewable energy uses. For instance, Opus, together with a UK-based consortium, is developing an

anti-ice coating 'Icemart', for the aerospace industry that could be applied to wind turbines: "As new coating technologies evolve there are going to be cross-sector applications for industries seeking improved operational performance, durability and reduced O&M [operation and maintenance] costs," said Hannan.

Riches says good solar energy coatings make sense: "Coatings make panels more efficient amongst other things. They generally increase the RoI [return on investment] of panels, which obviously is making them more competitive with other green technologies, as you end up getting better returns for your investment," he said.

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