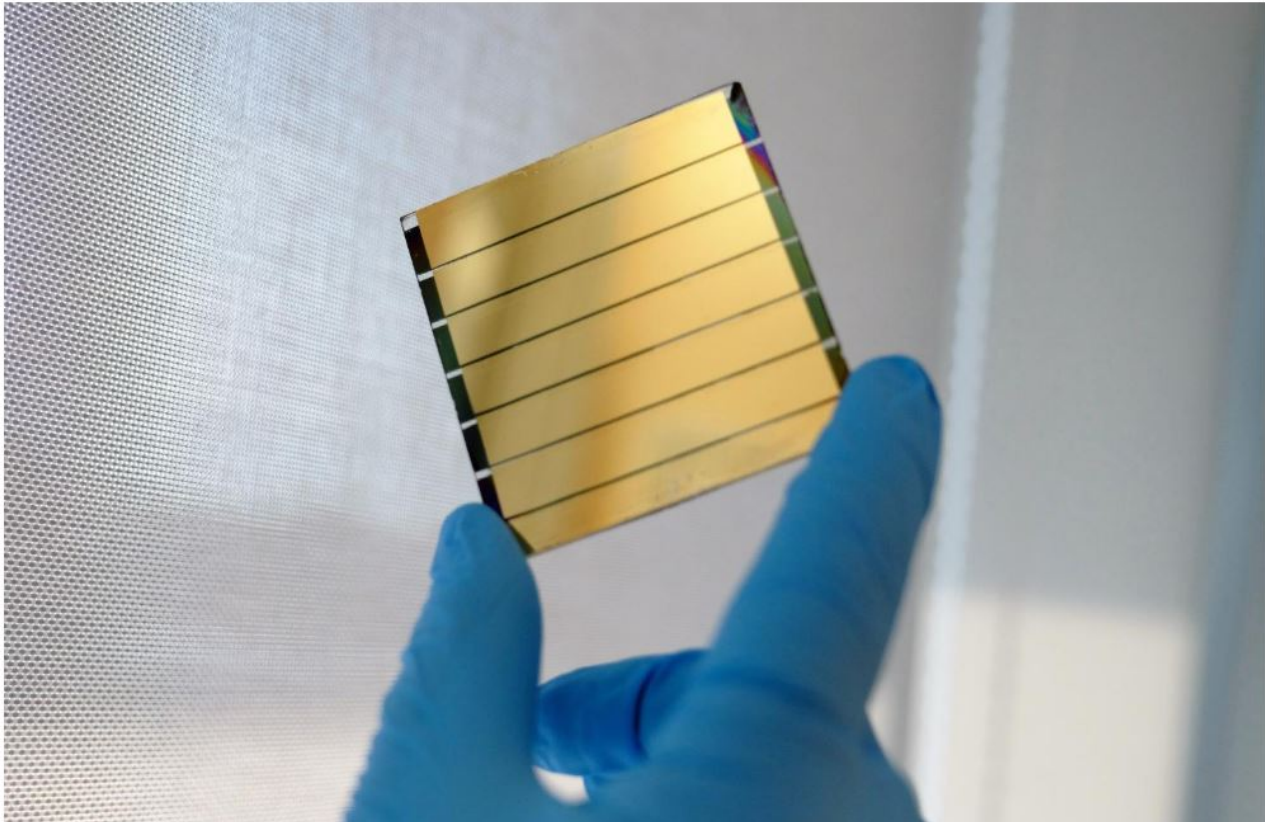




Singapore Team Develops Highest Power Conversion Perovskite Cells

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A team of researchers at the Nanyang Technological University, Singapore (NTU Singapore) has created a perovskite solar mini module that has recorded the highest power conversion efficiency of any perovskite-based device larger than 10 cm².

The researchers report that they have adopted a common industrial coating technique called 'thermal co-evaporation' and found that it can fabricate solar cell modules of 21 cm² size with record power conversion efficiencies of 18.1 per cent. These are the highest recorded values reported for scalable perovskite solar cells.

Thermal evaporation is an established coating technique currently used to produce electronics including Organic Light Emitting Diode (OLED) TVs.

Annalisa Bruno, senior scientist at the Energy Research Institute @ NTU (ERI@N) explained the roadblock in the large-scale adoption of perovskite solar modules in the scientific journal *Joule*: "The best-performing perovskite solar cells have so far been realised in the laboratory at sizes much smaller than 1 cm², using a solution-based technique, called 'spin-coating'. However, when used on a large surface, the method results in perovskite solar cells with lower power conversion efficiencies. This is due to the intrinsic limitations that include defects and lack of uniformity over large areas, making it challenging for industrial fabrication methods" she said.

"By using thermal evaporation to form the perovskite layer, our team successfully developed perovskite solar cells with the highest recorded power conversion efficiency reported for modules larger than 10 cm².

"Our work demonstrates the compatibility of perovskite technology with industrial processes, and its potential for market entry. This is good news for Singapore, which is looking to ramp up the use of solar energy for its power needs."

Research fellow at ERI@N and first author, Jia Li said, "We have demonstrated the excellent scalability of co-evaporated perovskite solar cells for the first time. This step will accelerate the transition of this technology from laboratory to industry."

More surface areas to harness sunlight with coloured perovskite solar cells

Utilising the same technique, the researchers then fabricated coloured semi-transparent versions of the perovskite solar cells and mini modules, which achieved similar measures of power conversion efficiency across a whole range of different colours.

These results demonstrate the versatility of the thermal evaporation method in producing a variety of perovskite-based solar devices for a variety of optoelectronic applications.

NTU associate VP (Strategy & Partnerships), Subodh Mhaisalkar, another author of the paper, said the findings open doors for Singapore and urban environments in other countries to harness the power of sunlight more efficiently than ever before.

"The solar mini modules can be used on facades and windows in skyscrapers, which is not possible with current silicon solar panels as they are opaque and block light. Building owners will be able to incorporate semi-transparent coloured solar cells in the architectural designs to harvest even more solar energy without compromising the aesthetic qualities of their buildings" said Mhaisalkar who is also executive director of the Energy Research Institute @ NTU (ERI@N).

Providing an independent view, Armin Aberle, CEO of the Solar Energy Research Institute of Singapore (SERIS) at the National University of Singapore (NUS) said, "This work represents the first demonstration of highly efficient large-area perovskite solar cells fabricated by an industrially compatible process. We are working closely with NTU in the future development of 30 percent efficient perovskite-on-silicon tandem solar cells in Singapore."

The NTU team is now looking at integrating perovskite and silicon solar cells to create a tandem solar cell. Such a configuration fabricated using cost-effective and scalable processes can substantially increase the solar electricity production per unit area while keeping production costs low.

'Highly Efficient Thermally Co-Evaporated Perovskite Solar Cells and Mini-modules' by Jia Li et al, Joule, 2 Apr 2020.