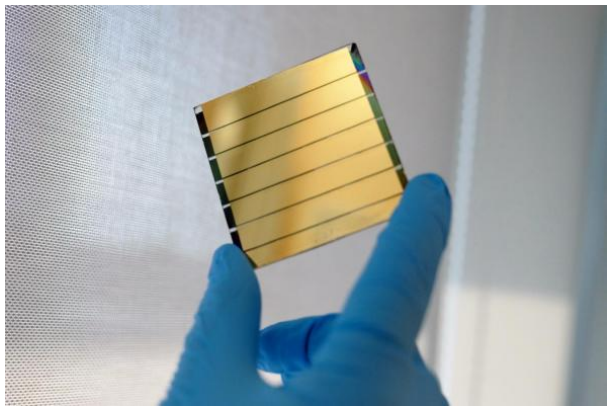
Large perovskite solar module sees record efficiency

July 20, 2020 //By Nick Flaherty



A team at NTU in Singapore have developed a large perovskite module with an efficiency of 18.1 per cent, a record for a large panel.

Researchers at Nanyang Technological University (NTU) in Singapore have created a perovskite solar mini module that has recorded the highest power conversion efficiency of any panel over 10 cm^2.

Perovskite materials are a hugely popular option for low cost, thin film solar cells that can be installed on roofs and buildings to generate power. Researchers have taken the efficiency of cells up to 28 percent and of tandem cells on top of a silicon cell up to 27 percent. Large area cells can be built in a number of ways, from spray coating to inkjet printing but the challenge has been to boost the efficiency of these larger modules.

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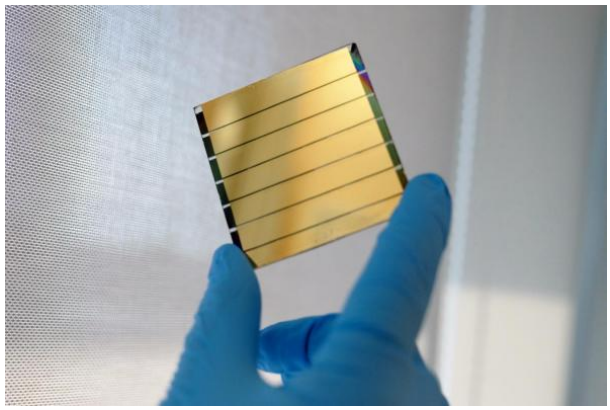
The NTU researchers used a common industrial coating technique called 'thermal co-evaporation' to build solar cell modules of 21 cm^2 size with record power conversion efficiencies of 18.1 per cent. The team says this is the highest recorded value reported for scalable perovskite solar cells. This thermal evaporation is an established coating technique currently used to produce electronics including Organic Light Emitting Diode (OLED) TVs.

"The best-performing perovskite solar cells have so far been realised in the laboratory at sizes much smaller than 1 cm^2, 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," said Dr Annalisa Bruno, Senior Scientist at the Energy Research Institute at NTU.

"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 cm^2. Our work demonstrates the compatibility of perovskite technology with industrial processes, and its potential for market entry.



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"This is good news for Singapore, which is looking to ramp up the use of solar energy for its power needs," said Bruno.

"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," said Dr Li Jia, research fellow at the Institute.

Using 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. This showed the versatility of the thermal evaporation method in producing a range solar devices. "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 Prof Subodh Mhaisalkar, Executive Director of the Energy Research Institute.

The team is working with the Solar Energy Research Institute of Singapore (SERIS) at the National University of Singapore (NUS) on the development of a 30 percent efficient perovskite-on-silicon tandem cell.