News

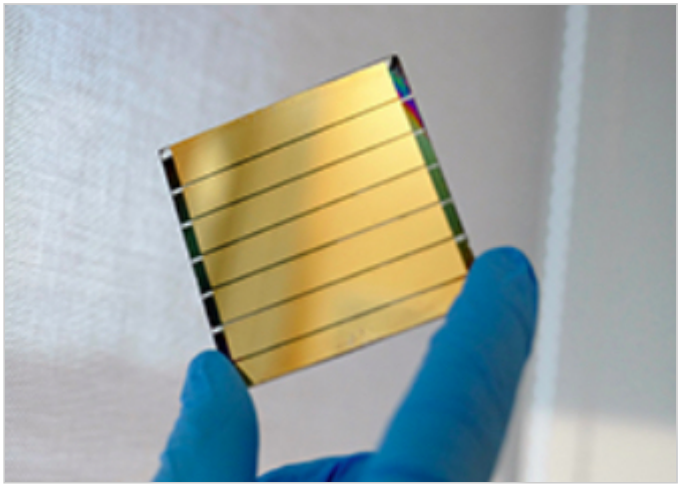
Singapore Scientists Achieve Highest Perovskite Power Conversion Efficiency

3 hours ago by Luke James

By using an existing method, the team from Singapore's Nangyang Technological University (NTU) has brought perovskites one step closer to market adoption.

Despite the mineral first being discovered in the Ural Mountains of Russia in 1839, it wasn't until 2012 that perovskite was first successfully used in solid-state solar cells. Since this time, scientists have been working tirelessly to make perovskite solar cells a more efficient and commercially-viable alternative to silicon in solar cell manufacturing.

Scientists are keen to use perovskite materials in the place of silicon in solar cell applications because the material offers similar power conversion efficiencies to silicon solar cells. It can also be used to create lightweight, flexible, and semi-transparent cells that are suited to a whole host of new applications.



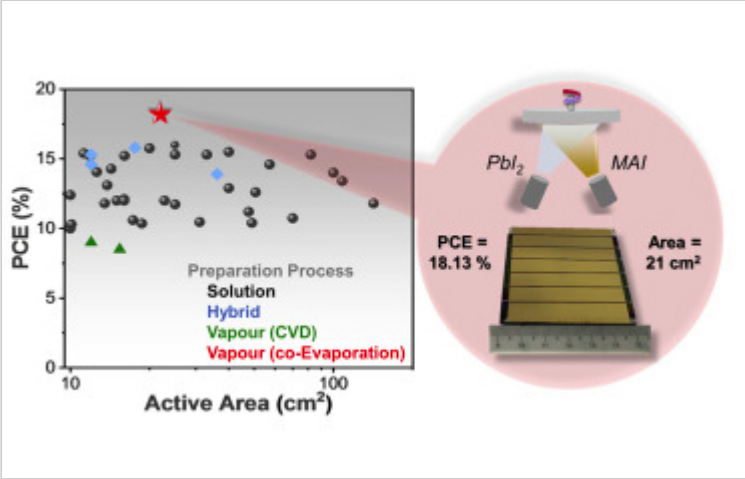
Perovskites can be used as light-weight, flexible solar cells. Image used courtesy of NTU Singapore

With all the research and development being pored into perovskite solar cells (PSCs) and perovskite technologies in general, the field is rapidly evolving and progressing toward industrialization. Now, only a few challenges remain, namely those of stability and scalability.

The Highest Power Conversion to Date

Researchers at Singapore's Nangyang Technological University (NTU) recently claimed that they've adopted a common industrial coating technique with record power conversion efficiencies. The technique, known as "thermal co-evaporation," can reportedly fabricate solar cells at 21 cm^2 in size with power efficiencies of 18.1%. To date, these are the highest recorded values that have been reported for scalable PSCs.

Dr. Annalisa Bruno, the lead author of the team's research, which was published in the journal *Joule*, said that the best-performing PSCs have been produced in laboratory settings at sizes much smaller than 10 cm^2 using "spin-coating."



The power conversion efficiency (PCE) of perovskite solar cells. Image used courtesy of Joule

However, when the spin coating is used on a large surface, it results in PSCs with lower power conversion efficiencies. This is because of defects and limitations such as a lack of uniformity. This makes the method unsuitable for industrial fabrication.

"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," Bruno explains.

Suitable for Different Optoelectronic Applications

Using the thermal co-evaporation technique, the research team also fabricated colored semi-transparent versions of the PSCs.

These achieved similar measures of power conversion efficiency across a range of different colors. This, the team claims, shows that the thermal evaporation method is highly versatile, capable of producing a variety of perovskite-based solar devices suited for different applications in optoelectronics.

This finding may support the uptick in perovskite LED use for display technologies.

Team of NTU Singapore researchers holding scaled up perovskite solar cells. Image used courtesy of NTU Singapore

Some of these applications could include the deployment of solar mini-modules on facades and in the windows of skyscrapers, which is not currently possible. Architects may even be able to integrate them into the very fabric of buildings themselves, claims Professor Subodh Mhaisalkar, NTU associate VP of strategy and partnerships.

The research team is now looking at integrating perovskite and silicon solar cells to create a "tandem" solar cell. If fabricated using cost-effective and scalable processes, the tandem cell could dramatically increase solar electricity production per unit area while cutting production costs.

The researchers are also hopeful that their work and findings will help accelerate the transition of PSCs from laboratory to industry.