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Spanish translation

The research that will end one of the great obstacles of perovskite solar panels

At Nanyang Technological University in Singapore, a team of researchers has presented an innovation that makes it possible to produce efficient, stable and ecological perovskite solar cells without the need to use lead.

Perovskites, which are materials with a crystalline structure, have the potential to replace silicon in photovoltaic solar panels, but they still need to overcome some challenges in order to compete with silicon solar cells on the market.

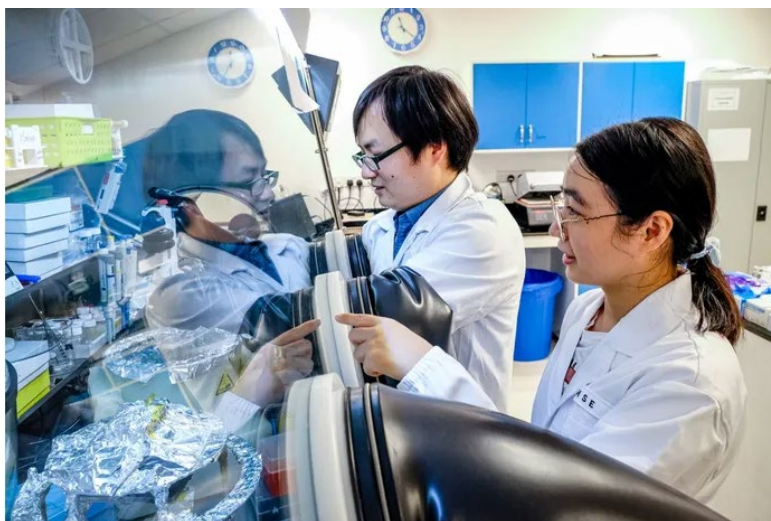
One of the main problems with perovskite solar panels is the use of lead in their production, a heavy metal that is highly polluting and can decompose when exposed to light and heat for long periods of time.

Scientists from Nanyang Technological University in Singapore and the Institute of Materials Research and Engineering at the Agency for Science, Technology and Research have conducted research to develop non-toxic materials for the production of perovskite solar cells.

The complete precursor (FP) solution method

In the study, which has been published in the prestigious scientific journal Nature Energy, the researchers used an alternative method known as the full precursor (FP) solution method instead of the half precursor (HP) method to fabricate the top protective layer of perovskite solar cells.

The FP method uses solutions containing metal halide salts and phenethylammonium iodide (PEAI) to coat perovskites without the need for lead.



To make the zinc-based top layer, the researchers dissolved the chemicals and coated the solution onto the perovskite layer in a glove box. The glove box protects the perovskite from oxygen and moisture in the environment before it is coated. Image: NTU Singapore

The researchers found the zinc-based compound PEA_2ZnX_4 to be the best capping material among others tested.

This compound is synthesised using the FP method, which does not require the extraction of lead ions from the underlying perovskite layer and allows the use of non-toxic metals in the coating layer. Furthermore, the FP method is more efficient than the HP method in manufacturing the protective layer.

To produce a solar cell with a PEA_2ZnX_4 cover layer, the researchers dissolved zinc halide salts and PEA in acetonitrile and applied the solution onto a perovskite layer attached to an electrically conductive glass substrate using the spin coating process.

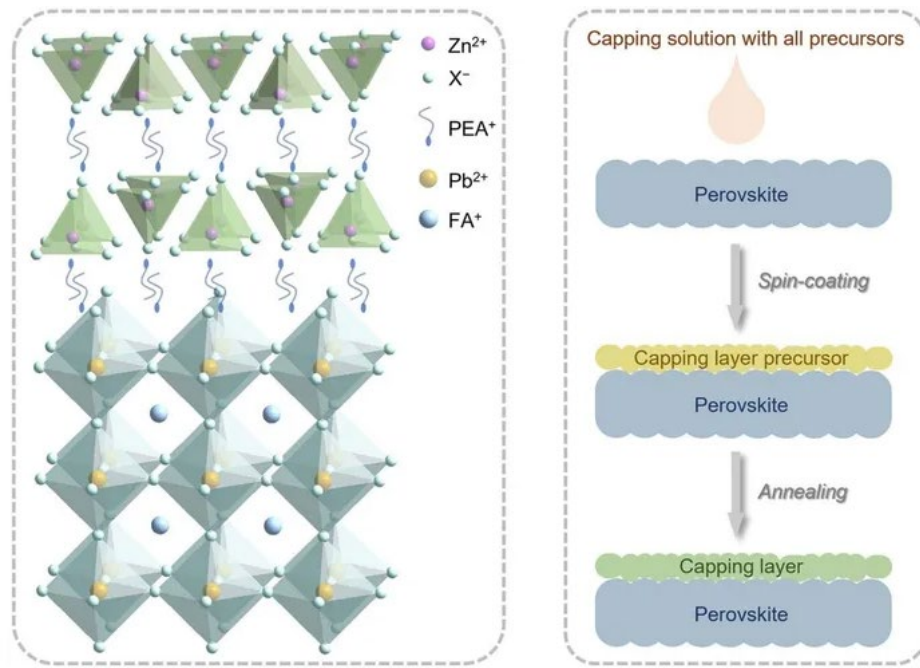
They then heated the coated perovskite and used the vacuum evaporation process to synthesise the other layers of the perovskite solar cell.

Advances in various fields

Experiments have shown that the top layer of the zinc-based material used in perovskite solar cells does not alter the electrical properties of the perovskite layer below.

In fact, this layer helps to cover the defects on the surface of the perovskite layer and to improve its ability to capture light.

In addition, the researchers have developed a method that enables the use of non-toxic, lead-free perovskite materials in the coating layer, making perovskite solar cells more environmentally friendly.



(Left) The molecular structure of perovskite (blue) with the zinc-based top layer (green). (Right) The FP process that the researchers used to coat the zinc-based coating layer on top of the perovskite layer. Image: NTU Singapore

This method also offers the possibility to design the composition of the coating layer to improve the performance of perovskite solar cells. The study showed that the fabricated solar cell was as efficient as conventional perovskite solar cells in converting sunlight into energy, and also demonstrated good reproducibility and long lifetime.

The researchers are now working to scale up the method to the production of full-size solar cells and file a patent with NTUitive, NTU Singapore's innovation company and enterprise.

Source: NTU / Photos: NTU