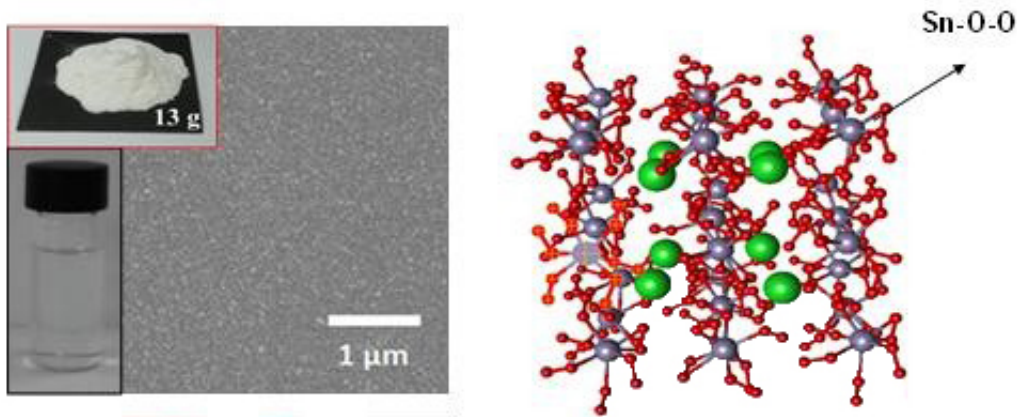


Next generation perovskite solar cells with new world-record performance

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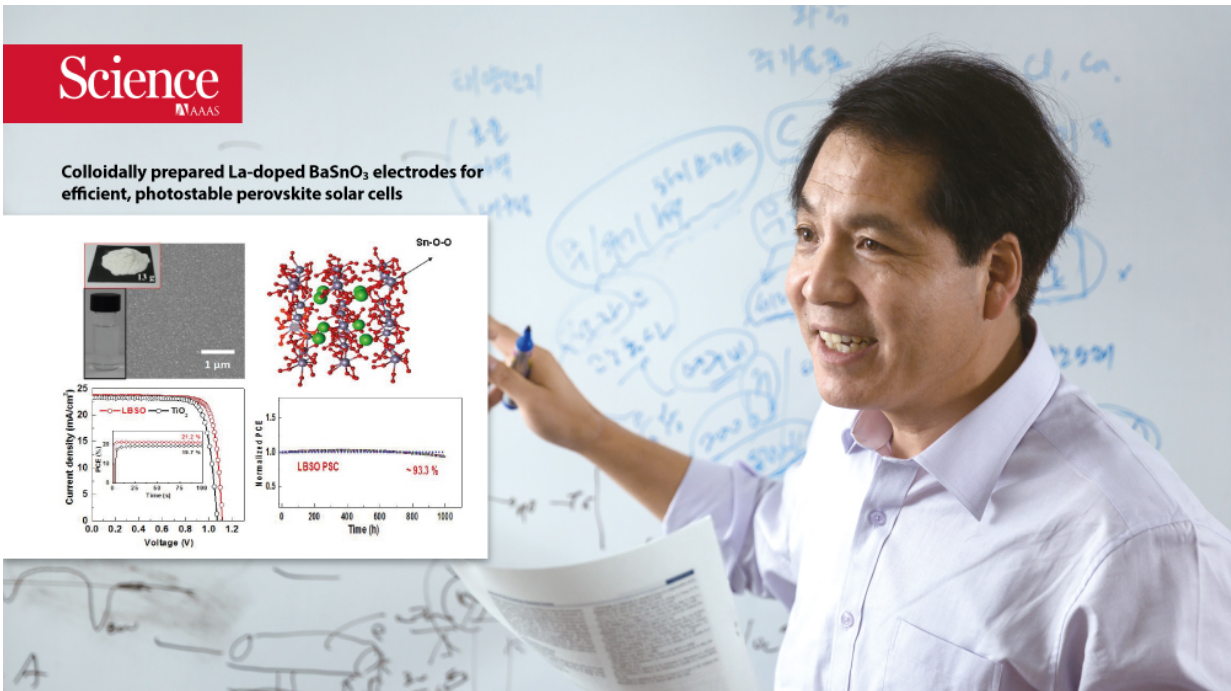
The schematic image above represents the LBSO powder prepared in the study, the solution dispersed in the solvent, and the thin film coated on the substrate. Shown right is the proposed crystal structure of the phase evolution in the CSMC route. Credit: UNIST

A recent study, affiliated with UNIST has presented a new cost-efficient way to produce inorganic-organic hybrid perovskite solar cells (PSCs) which sets a new world-record efficiency performance, in particular photostability. The research team envisions that this method and platform will significantly contribute to accelerate the commercialization of PCSs.

This breakthrough comes from a research, conducted by Distinguished Professor Sang-Il Seok of Energy and Chemical Engineering at UNIST in collaboration with Dr. Seong Sik Shin and Dr. Jun Hong Noh of Korea Research Institute of Chemical Technology (KRICT). Their results, published online in the March issue of the prestigious journal *Science*, has emerged as the most promising candidate for the next generation [high efficiency](#) solar cell technology.

PSCs are made of a mixture of organic molecules and inorganic elements within a single crystalline structure, that together capture light and convert it into electricity. It is an unique crystal structures, consisting of two cations and one anion. They can be fabricated easily and cheaply than silicon-based [solar cells](#), and on a flexible and rigid substrate. Moreover, PSCs reaching a photovoltaic efficiency of 22.1%, comparable to that of single crystalline silicon solar [cells](#) (25%), have been attracted much attention as the next-generation solar cells.

Professor Seok has led PSC technology as top scientist in the field. This achievement is based on the previous works (new architecture, process and composition for PSCs) by Professor Sang-Il Seok.



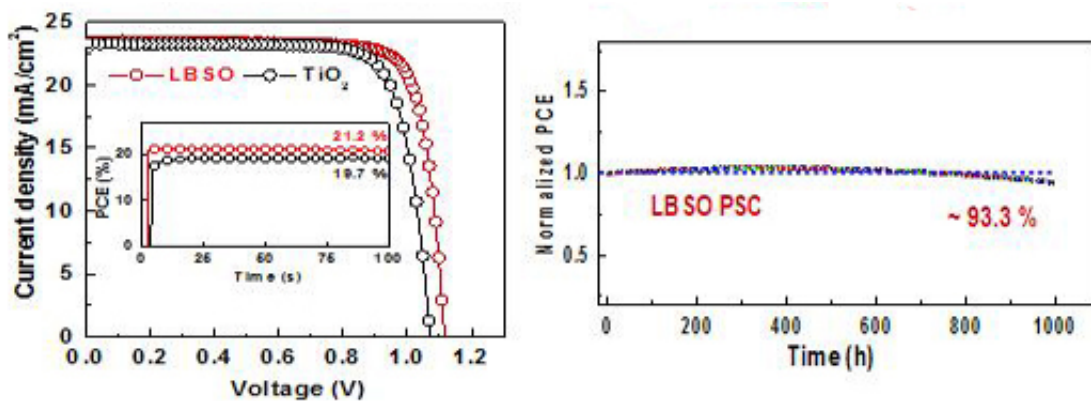
Distinguished Prof. Sang-II Seok of Energy and Chemical Engineering at UNIST. Credit: Hong Beom Ahn, Design by HyeJee Park

In this study, the research team reported the fabrication of PSCs satisfying both high efficiency (21.2%) and high photostability of the [perovskite solar cells](#) with photoelectrode materials (Lanthanum (La)-doped BaSnO₃ (LBSO)) synthesized by a very novel method under very mild conditions (below 200°C). They used methylammonium lead iodide (MAPbI₃) perovskite materials for PSCs.

Photostability refers to the ability to withstand exposure to light without a serious degradation. This new material, presented by Professor Seok's research team also retain 93% of its initial performance after 1,000 hours of exposure to sunlight. The synthesis of the photoelectrode material can also proceed at less than 200 °C, which is much lower than that of conventional (high temperature over 900 °C), making fabrication

much easier.

In the study, the research team has also proposed a new solar cell manufacturing methodology, entitled 'Hot-Pressing Method'. This method tightly adheres two objects by applying temperature and pressure. It allows the production of low-cost, high efficiency and stable perovskite solar cells.



The figure above shows the photovoltaic performance of the LBSO-based PSCs. After 1000 hours of full Sun illumination, only about 7% efficiency reduction was observed. Credit: UNIST

"This study combines the newly-synthesized photoelectrode material and the hot-pressing method to lower the manufacturing cost to less than half of the existing [silicon solar cells](#)," says Professor Seok, corresponding author of the paper. "This study helped us realize PSCs with a steady-state power conversion efficiency of 21.2% and excellent photostability."

He adds, "This achievement, realized by the unique technology of domestic researchers, has surpassed the conventional low-[efficiency](#) and stability limit of next-generation [solar cell technology](#)."

More information: Seong Sik Shin et al, Colloidally prepared La-doped BaSnO₂ electrodes for efficient, photostable perovskite solar cells, *Science* (2017). [DOI: 10.1126/science.aam6620](https://doi.org/10.1126/science.aam6620)

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