Rapid Layer-Specific Photonic Treatment for High-Speed Printing of Flexible Perovskite Solar Cells

THE UNIVERSITY OF ALABAMA | Research & Economic Development
Office for Innovation & Commercialization

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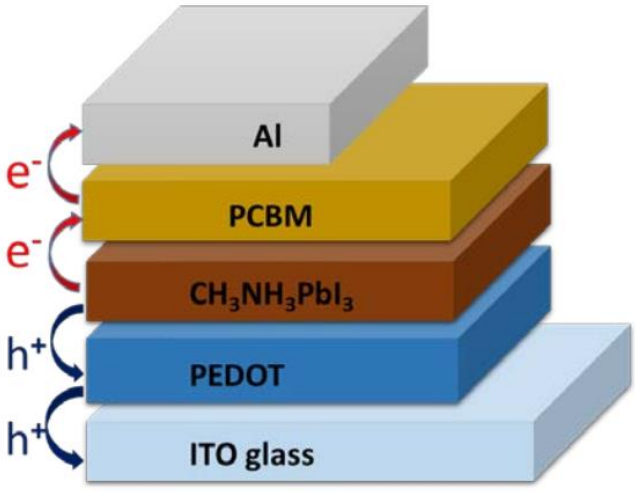
The Problem:

Perovskite solar cells (PVSCs) have continued to evolve greatly to become more appealing as a way to harness energy. However, they still have low efficiency, instability, and a long annealing time that holds them back from low-cost manufacturing. PVSC uses metal oxides as charge transport layers. These oxides must be formed into the desired crystallinity and the current method for this transition is hot plate annealing. A large drawback with this process is that the hot plates heat all the deposited layers simultaneously, which is destructive to the flexible substrates and perovskite active layer.

The Solution:

The novel invention utilizes a photonic treating technology, LED light, instead of the hot plate method. The LED light has a highly selective band of wavelength which can accomplish the layer-specific treatment for SnO2 and NiOx (metal oxides) without causing damage to the underlying films. Additionally, because LEDs can have a response time as low as 20 nanoseconds, they do not take a lot of time to “heat up” as other lamps do. This allows for precise control for pulsing the light.



Working Principle of Perovskite Solar Cells

Benefits:

- Localized annealing (does not harm the surrounding layers)
- High efficiency and high stability (higher energy conversion)
- Virtually no wait-time (allows for rapid printing)
- LEDs are low cost and highly selective

INVENTOR

Dr. Dawen Li
Professor, Department of Electrical and Computer Engineering

Dr. Dawen Li received his PhD in Electrical Engineering from the University of Michigan, Ann Arbor, in 2006.

Dr. Li was a post-doctoral research fellow at the University of Michigan, Ann Arbor. Dr. Li joined the University of Alabama in 2008. His areas of research focus on organic and perovskite-based photovoltaics (including tandem solar cells), and advanced manufacturing of perovskite solar modules through slow-die coating with integration of rapid photonic annealing.

Honors and Awards

- First prize in the Faculty Innovation Pitch Competition at the University of Alabama (2022)
- Firs place in UA Crimson Technology Innovation Contest (2017)
- CAREER Award, National Science Foundation (2012)

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