SACI Office of Society Academia Collaboration for Innovation
KYOTO UNIVERSITY

Ultrathin Perovskite Solar Cells

Background

Perovskite solar cells (PSCs) are a promising low cost-per-watt solar technology that has soared in efficiencies from 4% to 26% in the last decade. PSCs include a Perovskite layer composed of a ABX_3 crystal-structured hybrid organic–inorganic material sandwiched between several other layers. PSCs are thin, light, flexible, cheap and easy to produce. However, durability, scaling up, and the inclusion of a toxic metal lead as a component of perovskite materials are major bottlenecks precluding commercial-sized production of PSCs.

Technical Summary

The present invention is a mixed ultrathin tin-lead-based film for PSCs. The researchers made a highly purified tin-containing perovskite semiconductor material by partially replacing lead with tin. EDAI2 solution is used for the post-treatment of the perovskite top surface which has a polishing effect, washing away the surface layer of the perovskite film. The addition of GlyHCl ensures improved crystallinity and reduced defect densities at the bottom region. The application of a thin film increased the power conversion efficiency of PSCs to 23.6%.

➢ Even coating is achieved

The material is applied by a low-temperature wet coating process allowing for a highly uniform ultrathin film as shown in Fig. 1. The researchers plan to switch to roll- to-roll production that can be tailored to different applications and manufacturing scale in the future.

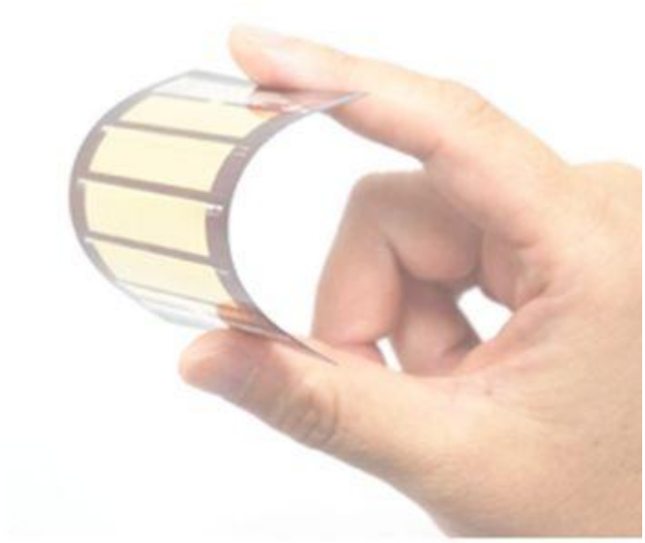

Figure 1. Low-temperature wet coating ensures ultrathin uniform film application.

➢ Durable for indoor usage

The inventors have cleared 10-year durability requirement for indoor usage of the PSCs. They are currently testing PSC-equipped IoT CO2 sensor terminals inside Tokyo Metropolitan Government facilities. Further R&D is required to optimize durability for outdoor usage of PSCs.

Technology Readiness Level
- 5

Potential Applications
- IoT sensors
- Wearable devices
- Emergency shelter tents
- Rooftop energy generation
- Space and solar sails

Possible Collaboration Mode(s)
- R&D collaboration
- Licensing
- Other

Patent No
WO2021182431

Publication(s)

Hu S, Otsuka K, Murdey R, Nakamura T, Truong MA, Yamada T *et al.* Optimized carrier extraction at interfaces for 23.6% efficient tin–lead perovskite solar cells. *Energy Environ Sci* 2022; **15**: 2096–2107.

Ohashi N, Kaneko R, Sakai C, Wasai Y, Higuchi S, Yazawa K *et al.* Stress-Compensated, Deformation-free Indium Tin Oxide Bilayer Electrodes for Ultrathin Flexible Perovskite Solar Cells. 2023. doi:10.21203/rs.3.rs-2426805/v1.

EneCoat is a spin-off from Kyoto University that develops PSCs for portable solar power supplies and IoT devices.

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