Stable Perovskites by Aerosol Processing (PV-3)

A joint India-U.S. research consortium funded under the *Joint Clean Energy Research & Development Center (JCERDC)*

Scientific Achievement:

We developed an electrospray technique to deposit highly stable, uniform, and moisture-resistant perovskite solar cells under high relative humidity (50%), without any encapsulation. The solar cells retain 70% of maximum efficiency after 4,000 hours (Fig. 2).

Significance and Impact:

The method we developed is scalable for fabricating efficient perovskite solar cells under ambient conditions.

Research Details:

- Perovskite layer was formed by the electrospray of CH_3NH_3I on spin-coated PbI_2 layer. CH_3NH_3I was electrosprayed at very low flow rate and reacted with PbI_2 through solid-solid reaction.
- Electrospray parameters (deposition time, CH_3NH_3I concentration, substrate-to-needle distance, flow rate) was optimized to get high-efficiency cells.
- Highly smooth and uniform perovskite layer forms as a result of controlled reaction between the two precursors. Perovskite layer fabricated by electrospray shows higher water contact angle than the layer fabricated by spin-coating technique.

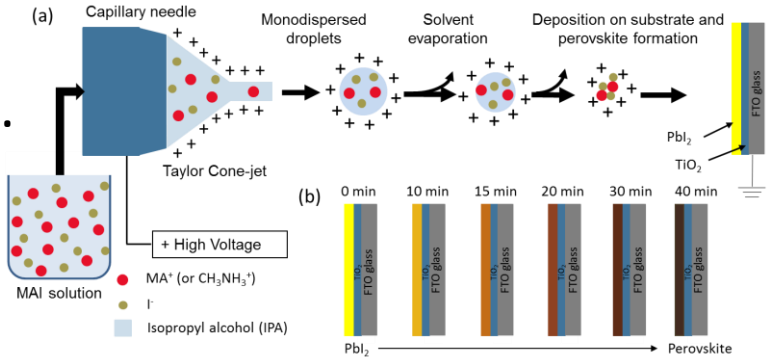

Figure 1. Schematic of electrospray deposition of CH_3NH_3I on PbI_2 layer to form perovskite layer.

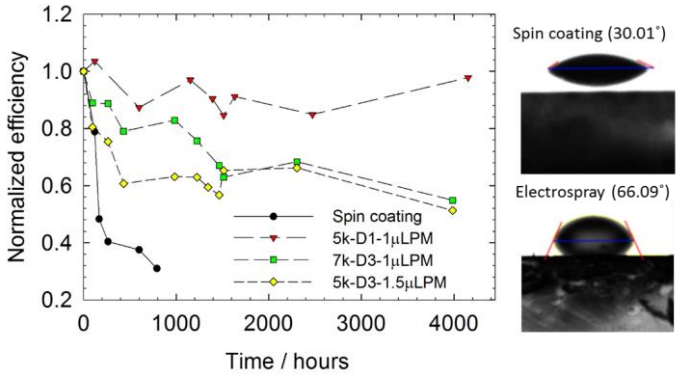

Figure 2. Long-term stability of the devices fabricated with spin coating (black dot) and electrospray (red, green yellow symbols).

Publication: S. Kavadiya., S. Huang, D.M. Niedzwiedzki, P. Biswas, Electrospray-assisted fabrication of moisture-resistant and highly stable perovskite solar cells at humid ambient conditions, *Advanced Energy Materials,* 1700210 (2017), **DOI:** 10.1002/aenm.201700210

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