Plasma-curing lowers the energy footprint of PV manufacturing

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Introduction

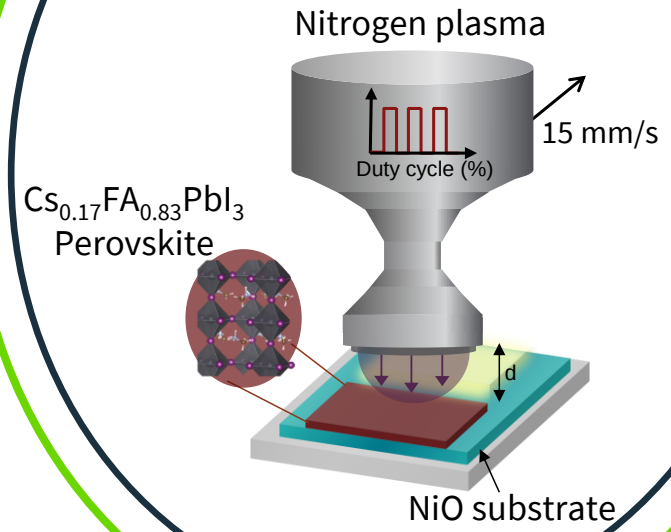
Renewable energy deployment is key to achieving carbon neutrality.

The solar panels currently deployed in the US are manufactured in Asia with significant environmental footprints as they require large amounts of material and energy during manufacturing.

Our goal is to scale up a new family of semiconductors, *metal halide perovskites*, which can be sprayed onto any surface (glass windows, flexible foils) using up to 10 times less energy and materials than conventional silicon wafers.

The current effort focuses on optimizing plasma curing conditions to obtain high-performing, stable solar cells.

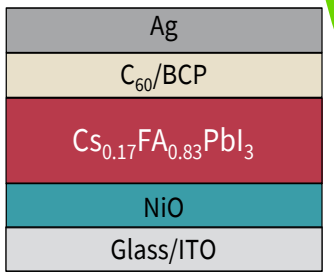
Rapid Spray Plasma Processing of perovskite layers



Materials And Methods

We use a spray-coating system* to deposit 5 subsequent layers and fabricate perovskite solar cells and modules.

The crystallization of the perovskite layer is controlled by tuning the processing speed, and the open-air nitrogen plasma parameters.

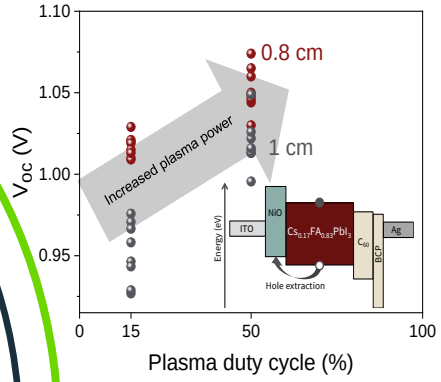


Perovskite solar cell structure

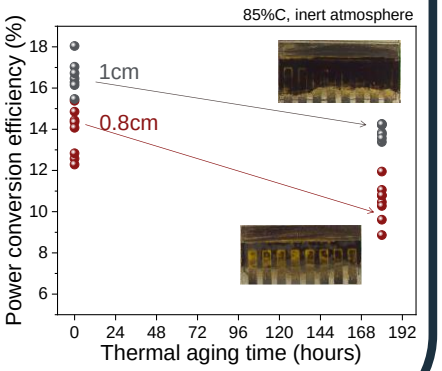
* Rolston, N. *et al.* Rapid Open-Air Fabrication of Perovskite Solar Modules. *Joule* **4**, 2675–2692 (2020).

Results

a. Solar cells open circuit voltage for various plasma conditions



b. Solar cells performance upon thermal aging



Discussion / Conclusion

- Various plasma conditions lead to solar cells with various photovoltaic performances and stability.

- The stronger the plasma exposure, the higher the solar cell open circuit voltage (V_{oc}). A correlation is found between the Plasma intensity and the NiO substrate chemistry (XPS).

- The stronger the plasma, the more heat damage in the perovskite absorber (PbI_2 byproduct formation), the worse the performance over time.

This work unveils the role of plasma processing on the performance and stability of perovskite solar cells and paves the way toward the commercialization of this promising photovoltaic technology.