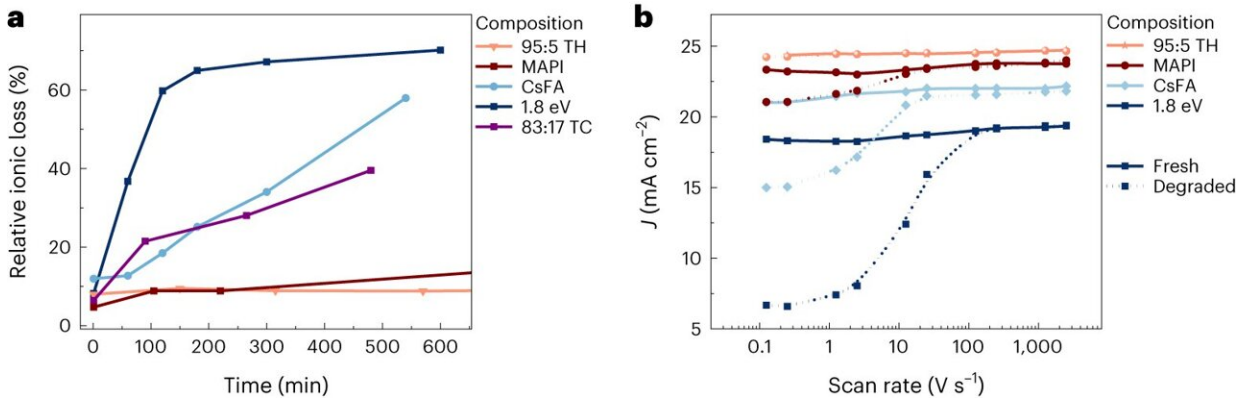
Team shows ion-induced field screening is a dominant factor in the operational stability of perovskite solar cells

March 28 2024, by Stefanie Mikulla



Overview of aging-induced ionic losses in various perovskite solar cells. **a**, The relative aging-induced ionic loss ($1 - PCE_{slow}/PCE_{fast}$) as a function of aging time under 1 sun open-circuit conditions demonstrates increasing ionic losses in all systems, though with varying magnitude depending on the individual composition. **b**, The J_{SC} measured at different scan speeds for fresh and aged cells after 5 h of aging under 1 sun open-circuit conditions. Credit: *Nature Energy* (2024). DOI: 10.1038/s41560-024-01487-w

Researchers from the University of Potsdam, together with colleagues

from other universities, have shown that ion-induced field screening is a dominant factor in the operational stability of perovskite solar cells. Their findings, published in the journal *Nature Energy*, lay the foundation for new strategies to improve the lifetime of the next-generation solar cells.

Solar energy from photovoltaics is one of the most widespread forms of renewable energy. Perovskite-based tandem solar cells are considered a next-generation technology and have eclipsed the performance of traditional silicon-based technologies. However, the perovskite stability lags significantly behind silicon cells by roughly one order of magnitude in lifetime.

The rather poor perovskite stability is usually attributed to electronic defects, electrode oxidation, the ionic nature of the perovskite, or chemical decomposition under moisture and oxygen. Understanding the underlying degradation mechanism is crucial to enable targeted improvements.

"In our article, we demonstrate that an increasing concentration of defects in the cells is apparently not a decisive factor for degradation," says Martin Stolterfoht, former leader of the Heisenberg junior research group PotsdamPero at the University of Potsdam and now professor at the Chinese University of Hong Kong.

Instead, it is the creation of more and more mobile ions under external stressors in the perovskite semiconductors that screen the built-in field in the perovskite absorber which leads to charge extraction losses.

"We have shown that the ion-induced field screening dominates the operational stability of various commonly used perovskite cells. For

example, we can use the ionic fingerprints detected in newly developed devices to accurately predict the stability of the cells," he adds.

These findings lay the foundation for new strategies to improve the cell lifetime and to accelerate the development of new perovskite cells with outstanding stabilities.

More information: Jarla Thiesbrummel et al, Ion-induced field screening as a dominant factor in perovskite solar cell operational stability, *Nature Energy* (2024). DOI: 10.1038/s41560-024-01487-w

Provided by Universität Potsdam