Long-term operating stability in perovskite photovoltaics

A review article that summarizes progress and challenges in improving the long-term operating stability of perovskite solar cells. It discusses the factors affecting stability, the strategies for ...

Lead halide perovskite solar cells (PSCs) have achieved remarkable efficiencies comparable to those of their established silicon counterparts at a very fast pace. Moreover, solution-processable facile technologies offer low-cost, low-temperature, scalable fabrication of these solar cells. Numerous studies have focused on improving the performance, stability, and ...

The long-term operational stability of perovskite photovoltaics is critical to their successful real-world deployment. New research shows that ammonium cations with a high acid-dissociation ...

Bush, K. A. et al. 23.6%-eficient monolithic perovskite/silicon tandem solar cells with improved stability. Nat. Energy 2, 17009 (2017). 131. Wu, Z. et al. Highly eficient and stable perovskite solar cells via modification of energy levels at the perovskite/carbon electrode interface. Adv. Mater. 31, 1804284 (2019). 132.

2D perovskite structures have gained significant attention due to their reliable long-term stability. Unlike quasi-2D perovskites, phase-pure 2D perovskites exhibit a flattened ...

Long-term operating stability in perovskite photovoltaics Nature Reviews Materials (IF 79.8 Submission Guide >) Pub Date: 2023-08-04, DOI: 10.1038/s41578-023-00582-w Hongwei Zhu, Sam Teale, Muhammad Naufal Lintangpradipto, Suhas Mahesh, Bin Chen, Michael D. McGehee, Edward H. Sargent, Osman M. Bakr

Perovskite solar cells (PSCs) with mesoporous TiO 2 (mp-TiO 2) as the electron transport material attain power conversion efficiencies (PCEs) above 22%; however, their poor long-term stability is a critical issue that must ...

Solar cells had a power conversion efficiency of more than 25%, and they retained more than 95% of efficiency after 2000 hours of maximum power point operations at 65°C. --Phil Szuromi Robust contact schemes that boost stability and simplify the production process are needed for perovskite solar cells (PSCs).

Organic hole transport layers (HTLs) have been known to be susceptible to thermal stress, leading to poor long-term stability in perovskite solar cells (PSCs). We synthesized three 2,5-dialkoxy-substituted, 1,4-bis(2-thienyl)phenylene (TPT)-based conjugated polymers (CPs) linked with thiophene-based (thiophene (T) and thienothiophene (TT)) comonomers and ...

Although, in this case, the presence of PbI 2 caused only a slight reduction in device performance. Multiple reports have monitored the thermal stability of the perovskite under vacuum conditions. As previously

mentioned, Philippe et al. observed the decomposition of the perovskite film after heating at 100 °C.

With a record efficiency above 25%, the main hurdle for the commercialization of perovskite solar cells (PSCs) is their long-term operational stability. Although different strategies have been applied, the stability of PSCs is still far below the 25 year requirement demonstrated by commercial photovoltaic technologies.

The long-term stability of perovskite solar cells has been improved with an atomic-layer deposition (ALD) method that replaces the fullerene electron transport layer with tin ...

Despite the swift development in perovskite solar cells (PSCs), great concerns regarding environmental vulnerability propose a big challenge for their long-term operational ...

Despite being a persistent problem in perovskite photovoltaics, stability has improved by orders of magnitude in the first decade of mainstream perovskite PV research. With the introduction of various stability enhancing methods, the operational stability of PSCs is maturing beyond practically achievable testing lifetimes.

Perovskite solar cells have demonstrated the efficiencies needed for technoeconomic competitiveness. With respect to the demanding stability requirements of photovoltaics, many techniques have been used to increase the stability of perovskite solar cells, and tremendous improvements have been made over the course of a decade of research. Nevertheless, the ...

projected 5 years of operating stability for PSCs based on an accel-erated aging model. Among solar cell technologies, perov-skites are candidates of interest: they have seen rapid ...

Gao et al. report that the addition of molecular engineered multi-functional ionic liquid into perovskite layer affords high-quality perovskite solar cells with long-term stability and >21% power-conversion efficiency. The unencapsulated devices retain >95% of their original efficiency after 1,000 hours of aging.

Perovskite solar cells (PSCs) have attracted much attention in the past decade and their power conversion efficiency has been rapidly increasing to 25.2%, which is comparable with commercialized solar cells. Currently, the long-term stability of PSCs remains as a major bottleneck impeding their future commercial applications. Beyond strengthening the perovskite ...

The introduction of 3TPYMB, an n-type molecule into inverted perovskite solar cells, enables a power conversion efficiency of 25.6%, with devices maintaining up to 98% of the initial efficiency ...

Of remaining concern is stability under stress, such as temperature, light exposure, humidity, and electric fields. 1 The perovskite (ABX 3) photoactive layer itself is one factor (here A represents a monovalent cation such as methylammonium [MA +], formamidinium [FA +], cesium [Cs +], or a combination thereof; B corresponds to Pb 2+ or Sn 2+; and X stands for halides ...

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Stability of perovskite solar cells: issues and prospects. ... biggest hurdles of a successful perovskite technology are to develop a low-cost manufacturing technique and ensure the long-term stability of the device. We believe that PSCs will be able to dominate the market if these two concerns can be remedied. ... operating at room temperature ...

To understand degradation routes and improve the stability of perovskite solar cells (PSCs), accelerated aging tests are needed. Here, we use elevated temperatures (up to 110°C) to quantify the accelerated degradation of encapsulated CsPbI 3 PSCs under constant illumination.

The resultant perovskite solar cells deliver a power conversion efficiency of 25.7% (certified 25.04%) and retain >90% of their initial value after almost 1000 hours aging at maximum power point ...

Engineering long-term stability into perovskite solar cells via application of a multi-functional TFSI-based ionic liquid. ... operating at 10 kV. One-dimensional XRD analysis was performed with a D8 Advance diffractometer (Bruker) with Cu Ka radiation (lKa = 1.5418 Å) by measuring the diffraction angle (2th) between 10° and 60°. 2D-WAXS ...

The bidirectional migration of halides and silver causes irreversible chemical corrosion to the electrodes and perovskite layer, affecting long-term operation stability of perovskite solar cells.

It has been more than a decade since perovskite solar cells emerged as potential alternative of conventional solar devices. The field has made huge progress with respect to photovoltaic performance, long-term stability, fabrication methods, modulization, etc. The PCE of perovskite single-junction solar cell almost ties that of the best Si solar ...

A direct comparison of stability data of perovskite solar cells is challenging due to widely different measurement conditions and reporting standards. Here, the authors propose a single indicator ...

Due to the high industrial interest for perovskite-based photovoltaic devices, there is an urgent need to fabricate them under ambient atmosphere, not limited to low relative humidity (RH) conditions. The formamidinium lead iodide (FAPI) perovskite a-black phase is not stable at room temperature and is challenging to stabilize in an ambient environment. In this work, we ...

Consequently, we thus evaluated the long-term operational stability of the resulting encapsulated device under continuous AM 1.5 illumination in ambient air at room temperature (relative humidity of 20% to 30%), following the International Summit on Organic PV Stability of light soaking tests (ISOS-L-1). 54 As shown in

Figure 5D, the ...

At present, the long-term stability of emerging technologies such as organic photovoltaic (OPV) cells, dye-sensitized solar cells (DSSCs) and halide perovskite solar cells (PSCs) is not meeting this target and improvements are hampered by a lack of understanding of the module failure modes.