Regulating perovskite crystal plane orientation cells

Crystal orientations in multiple orders correlate to the properties of polycrystalline materials, and it is critical to manipulate these microstructural arrangements to enhance device performance.

The crystal growth and orientation of two-dimensional (2D) perovskite films significantly impact solar cell performance. Here, we incorporated robust quadrupole-quadrupole interactions to ...

Herein, the favored crystal orientation of MAPbI 3 perovskite is finely tuned by additive engineering for carbon based printable mesoscopic perovskite solar cells (PSCs). By introducing biguanide hydrochloride (BH), the out-of-plane crystal orientation of perovskite film is notably enhanced along the (001) and (002) crystal plane, which affects ...

The X-ray diffraction (XRD) measurement of the perovskite films added with varing concentrations of Cs + was conducted (Figure 2a; Figure S2, Supporting Information) contrast to the control film, the 2th of the (100) plane of the cubic perovskite phase gradually shifts to a larger angle with the increase of Cs + content. It indicates that lattice compression ...

This method significantly promotes the desired crystal orientation, passivates defects, and mitigates photo-induced halide phase segregation in perovskite films, leading to ...

In this contribution, we examine and manipulate the crystal facet orientation upon crystallographic plane stacking via cation cascade doping in the mixed perovskite thin films.

The wide-bandgap perovskite solar cell is a crucial part of perovskite/silicon tandem solar cells, which offer an avenue for surpassing the power conversion efficiency (PCE) limit of single ...

<p>Metal halide perovskite solar cells have attracted considerable attention because of their high-power conversion efficiency and cost-effective solution-processable fabrication; however, they exhibit poor structural stability. Two-dimensional (2D) Ruddlesden-Popper (RP) perovskites could address the aforementioned issue and present ...

INTRODUCTION. The power conversion efficiencies (PCEs) of perovskite solar cells (PSCs) have improved rapidly from 3.8% to a certified 25.2% for single junction devices and approaching 30% for perovskite-based tandem devices in the past few years [] ch excellent performance can be mainly attributed to their long carrier diffusion lengths and low trap ...

Given that the surface energy of the (1 0 0) crystal plane is lower than that of the (0 1 0) crystal plane, orderly stacked polymer molecular chains tend to form a stable arrangement exposing the (1 0 0) crystal plane to the exterior, resulting in ...

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A well-developed perovskite crystal at the beginning of a crystal lattice facilitates favourable growth orientation for efficient charge transport and the elimination of buried interfaces. However, rapid and ...

Tandem perovskite cells The ready processability of organic-inorganic perovskite materials for solar cells should enable the fabrication of tandem solar cells, in which the top layer is tuned to ...

2D BA 2 PbI 4 Regulating PbI 2 Crystallization to Induce ... Using seeds to control the crystallization of perovskite film is an effective strategy for achieving high-efficiency perovskite solar cells (PSCs). ... which allows the realization of perovskite film with preferential crystal orientations of (001) and large grain size of over 2 µm ...

Figure S5. Orientation of the perovskite crystal. (A and B) 2D-GIWAX images of control and BAEE-treated films. (C) 1D Azimuthal intensity plots along the ring at q = 1.0 Å-1, assigned to the (001) plane of the perovskite film. Figure S6. XRD patterns. (A) pristine NiOx and BAEE (0.2, 0.4, 0.5, and 1.0 mg/mL) modified NiOx films.

To achieve highly oriented perovskite thin films, crystal orientation engineering has been developed to control the crystallographic orientation of perovskites by altering the surface energies of different facets, which enables the ...

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Formamidinum lead iodide perovskite solar cells commonly suffer from photoinduced phase segregation and humidity instability. Here, the authors design a ...

The OSS-based tin-halide perovskite film exhibits (100) out-of-plane crystal orientation and improved carrier diffusion length, resulting in a certified PCE of 14.6%, which is the highest for a tin-based PSC. ... we focus on the strategies ...

Quasi-two-dimensional perovskite films, fabricated through solution processing, often consist of self-assembled multi-quantum well structures. Unfortunately, the presence of low-n phases acts as a recombination center, impeding efficient carrier transport and extraction. A general method of regulating phase composition was developed, which effectively reduced ...

Perovskite solar cells (PSCs) are efficient, low-cost photovoltaic devices [1], [2] that have achieved a certificated power conversion efficiency (PCE) of 26.1 % [3], but their poor long-term stability [4], [5] hinders their commercialization prospects. During the thermal annealing of perovskite thin films, the mismatched thermal expansion between perovskite films and ...

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Formamidinum lead iodide perovskite solar cells commonly suffer from photoinduced phase segregation and humidity instability. Here, the authors design a multifunctional fluorinated additive to ...

planes of a-FAMAPbI 3 perovskite (Figures S4AandS6).1,26 While BAEE molecule-treated perovskite film with well crystallization and preference orientation (001) has been observed compared with the pristine in GIWAX results (Figures S4Band S4C), suggesting the BAEE can assist perovskite crystal growth of perovskite film

In this work, we take double perovskite oxide PrBa0.5Sr0.5Co1.5Fe0.5O5+d (PBSCF) as a model system to demonstrate enhancing OER activity through the promotion of PCET by tuning the crystal ...

Tin (Sn)-based perovskite solar cells (PSCs) have attracted much attention because they are more environmentally friendly than lead-based PSCs. However, the fast crystallization of Sn-based perovskite films and the easy oxidation of Sn2+ to Sn4+ hinder the improvement of their efficiency and stability. In th

With the rapid rise in perovskite solar cells (PSCs) performance, it is imperative to develop scalable fabrication techniques to accelerate potential commercialization. However, the power conversion efficiencies (PCEs) of ...

The undesired film quality with disordered microstructure arrangement and notorious defects mainly arise from the random nucleation and chaotic diffusion growth in spontaneous solution chemical reactions process [14], [15].Jung et al. found that a limited degree of reactant supersaturation in perovskite solution is prone to causing a low density of ...

Ionic liquid regulating perovskite film for air-processed perovskite solar cells ... 28.49°, and 31.8° corresponds to (110), (220), and (310) crystal planes of perovskite cubic phase ... The higher-quality perovskite film with favorable crystallization and benign crystal growth orientation is also mirrored in the enhanced light absorption in ...

The GIWAXS was conducted to characterize the orientations in both in-plane and out-of-plane directions of NBG (x = 0.1) (Figure 1d-f) and WBG (x = 0.3) (Figure 1g-i) perovskite films.The diffraction rings at q z = 1.4 Å -1 are assigned to the (111) planes. The rings at q = 1.0 and 2.0 Å -1 are assigned the (001) and (002) planes, respectively. . The azimuth ...

Metal-halide perovskite solar cells have garnered significant research attention in the last decade due to their exceptional photovoltaic performance and potential for commercialization. Despite achieving remarkable power conversion efficiency of up to 26.1%, a substantial discrepancy persists when compared to the theoretical Shockley-Queisser (SQ) limit. One of ...

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Abstract. Buried interface in perovskite solar cells (PSCs) is currently a highly focused study area due to their impact on device performance and stability. However, it ...

This method significantly promotes the desired crystal orientation, passivates defects, and mitigates photo-induced halide phase segregation in perovskite films, leading to substantially ...

Just as in the case that silicon wafers have revolutionized modern industries including electronics and solar cells, the availability of perovskite crystal wafers may pave the way to functional ...

Regulating buried interface and crystal orientation by METEAM. The FAPbI 3 perovskite films were deposited via a one-step process with a small amount of METEAM (0.6 ...

The success in crystal orientation engineering enables the preferential growth orientation of perovskite thin films with favorable crystal planes by precise nucleation manipulation and growth ...

The success in crystal orientation engineering enables the preferential growth orientation of perovskite thin films with favorable crystal planes by precise nucleation manipulation and growth condition optimization, rendering the films with the unique optoelectronic properties to further improve the efficiency of perovskite solar cells (PSCs).

to be crystal orientation.6,15-19 Different crystal facets of perovskite possess distinct CONTEXT & SCALE The high quality of perovskite light-absorbinglayerandreduced interfacial defects have brought a significant improvement to the power conversion efficiency (PCE) of perovskite solar cells (PSCs). It is well acknowledged that