Solar Cell Crystal Orientation

How can crystal orientation engineering improve the efficiency of perovskite solar cells?

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).

Does crystal orientation affect power conversion efficiency of quasi-2D perovskite solar cells?

However,the power conversion efficiency (PCE) of quasi-2D perovskite solar cells decreasesunfortunately with the increase of the 2D contents,which obviously depends on the orientation of the crystals. In this review,we first review the effect of the crystal orientation on the performance of quasi-2D PSCs.

What is the preferential orientation of crystal growth?

If the nucleation is initiated at the liquid-air interface,crystal growth has a clear preferential orientationcompared to nucleation in the isotropic liquid or at the rough liquid-substrate interface (Figure 3B).

How does crystal orientation affect optoelectronic properties?

The crystal orientation directlyaffects the optoelectronic properties. It is well-known that oriented crystals provide more efficient charge transport,giving rise to higher JSC and FF,but the impact of different crystal orientations on the internal electric field of PSCs is still unknown.

Why is molecular orientation important in organic solar cells?

The regulation principle of optimizing molecular orientation is revealed. The morphological characteristics of the active layer in organic solar cells (OSCs),encompassing phase separation structure,domain sizes,crystallinity and molecular orientation play a pivotal role in governing the photoelectric conversion processes.

Why is crystal orientation important?

Manipulating the crystallographic orientation of semiconductor crystals plays a vital role in fine-tuning their facet-dependent properties,such as surface properties,charge transfer properties,trap state density,and lattice strain. The success in crystal orientation engineering enables the preferential g Recent Review Articles

Notably, molecular orientation holds paramount significance as it exerts influence over key aspects such as light absorption, exciton dissociation, charge transport, and ...

Crystal orientations are closely related to the behavior of photogenerated charge carriers and are vital for controlling the optoelectronic properties of perovskite solar cells. Herein, we propose a facile approach to reveal the effect of lattice plane orientation distribution on the charge carrier kinetics via constructing CsBr-doped mixed cation perovskite phases. With ...

These discoveries provided new sights into how to enable crystallinity and crystal orientation control in quasi-2D perovskites for high-performance solar cells. In addition, ...

Here, by investigating the initial stages of the crystallization, as well as partially and fully formed perovskites grown using MACl, the origins underlying this favorable alignment are inferred. This mechanism is studied by employing 3-fluorobenzylammonium in quasi-2D perovskite solar cells.

Fig. 2 d schematically illustrates the optimized crystal orientation by the introduction of TFA, which could effectively improve the carrier transportation ability. Such optimization would further promote the optoelectronic performance of Sn-based perovskites and is beneficial for the application in perovskite solar cells.

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 uncontrollable crystallization of perovskites poses significant challenges in achieving desired growt Recent Open Access Articles

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3 ???· The performance of narrow-bandgap (NBG) perovskite solar cells (PSCs) is limited by the severe nonradiative recombination and carrier transport barrier at the electron selective ...

Perovskite film made on the NiO/DEA layer showed significantly enhanced intensity of the (110) and (220) peaks, indicating preferential orientation of the perovskite crystals. Solar cells based on DEA-modified NiO achieved high FF ...

Mixed tin-lead perovskite solar cells (PSCs) have garnered much attention for their ideal bandgap and high environmental research value. However, poly (3,4-ethylenedioxythiophene): poly (styrene sulfonate) (PEDOT: PSS), widely used as a hole transport layer (HTL) for Sn-Pb PSCs, results in unsatisfactory power conversion efficiency (PCE) and ...

Enhancing carrier collection in CsPbBr 3 solar cells through crystal orientation and defect passivation Haotian Dong . 0009-0008-8558-1997 ; Haotian Dong (Conceptualization, Data curation, Formal analysis, ...

These discoveries provided new sights into how to enable crystallinity and crystal orientation control in quasi-2D perovskites for high-performance solar cells. In addition, mixing different anions can further tailor the crystallization process of perovskites and improve carrier transport. For example, Li et al. compared the ...

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Controlling crystal growth alignment in low-dimensional perovskites (LDPs) for solar cells has been a persistent challenge, especially for low-n LDPs (n < 3, n is the number of octahedral sheets ...

Bifunctional ligand-induced preferred crystal orientation enables highly efficient perovskite solar cells Perovskite solar cells (PSCs) have drawn significant attention due to their skyrocketed power conversion efficiency (PCE). Crystallization orientation and the buried interface have been proven to be key factors determining the ...

Notably, molecular orientation holds paramount significance as it exerts influence over key aspects such as light absorption, exciton dissociation, charge transport, and collection.

Crystallization orientation and the buried interface have been proven to be key factors determining the efficiency of perovskite solar cells (PSCs). Here, we report a facile strategy to concomitantly induce (100)-oriented perovskite and improve buried interface by incorporating a bifunctional ligand 2-(methylthio) ethylamine hydrochloride (METEAM) into ...

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