Triple-junction all-perovskite solar cell

How efficient are all-perovskite triple-junction solar cells?
In a combination of 1.73 eV,1.57 eV,and 1.23 eV perovskite sub-cells,we further demonstrate a power conversion efficiency of 16.8%for monolithic all-perovskite triple-junction solar cells. Integrating several different perovskite absorber layers in a multi-junction solar cell imposes a great processing challenge.

Can a multi-junction solar cell be integrated with multiple perovskite absorber layers?
Integrating several different perovskite absorber layers in a multi-junction solar cell imposes a great processing challenge. Here,the authors demonstrate a versatile two-step solution process for fabricating monolithic all-perovskite triple-junction solar cells.

Are perovskite-based high-efficiency triple-junction solar cells a new era?
This work opens the door to a new eraof perovskite-based high-efficiency triple-junction PVs. Recent advancements in power conversion efficiencies (PCEs) of monolithic perovskite-based double-junction solar cells1-8 denote just the start of a new era in ultra-high-efficiency multi-junction photovoltaics (PVs) using three or even more junctions.

How are single-junction perovskite solar cells fabricated?
The single-junction perovskite solar cells (middle or top sub-cell) were fabricated in a p-i-n architectureof ITO/2PACz/perovskite/(LiF)/C60/BCP/gold (Au). ITO substrates (sheet resistance 15 ? sq-1,Luminescence Technology) were cleaned with acetone and isopropanol in an ultrasonic bath for 10 min,respectively.

What is a perovskite solar cell?
Perovskite materials offer both band-gap tunability and solution processability. This unique combination of properties allows for fabrication of multi-junction solar cells using high-throughput deposition techniques such as blade coating, roll-to-roll, gravure coating or inkjet printing.

What is a monolithic all-perovskite triple-junction cell?
Monolithic all-perovskite triple-junction cells with an open-circuit voltage of 2.8 V and a fill factor of 81.1%are obtained by developing interconnecting layers that are compatible with the solution processing of perovskite absorbers.

According to a recent simulation by Hörantner et al., triple junction solar cells based on all-perovskite and perovskite-perovskite-silicon could reach efficiencies of 37% and 39% ...

Moreover, the advancements in single-junction TLPSCs have propelled the development of multi-junction all-perovskite TSCs, including double-junction and triple-junction architectures. Furthermore, significant efforts are being devoted to scaling up all-perovskite TSCs from laboratory scale to large-area perovskite solar modules (PSMs).

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For example, Tan"s group fabricated monolithic all-perovskite triple-junction solar cells with an efficiency of 20.1% and an V oc value of 2.80 V (Fig. 12d) 169. This triple-junction device was ...

Taking advantage of this, the research on the triple-junction (TJ) silicon-perovskite-perovskite (Si-PVK-PVK) solar cells has gained attention, although it is still in an early stage of development. In this mini-review, the working mechanism, the design principle, and the progress of TJ Si-PVK-PVK solar cells are discussed.

Developed by scientists in Germany, the triple-junction cell is based on a perovskite top cell with an energy bandgap of 1.84 eV, a perovskite middle cell with bandgap of 1.52 eV, and a silicon ...

Fig. 1 (a) Use of the solar spectrum by a triple-junction solar cell consisting of a silicon bottom cell, a 1.50 eV middle cell (e.g. GaInAsP), and a 2.00 eV top cell (e.g. AlGaInP). The ...

All-perovskite triple-junction solar cell devices have been fabricated, with a certified efficiency of 23.3%; these devices retain 80% of their initial efficiency following 420 hours of operation. ... Expand

We demonstrate a highly current-matched monolithic all-perovskite triple-junction solar cell enabled by controlled thermal co-evaporation of various perovskite absorber ...

The efficient wide-bandgap sub cell enables the fabrication of monolithic all-perovskite triple-junction solar cells with an open-circuit voltage of 3.33 V and a champion PCE of 25.1% (23.87% ...

Multi-junction solar cells utilizing lattice-matched III-V compound semiconductors like GaInP and GaAs have thus far reached the greatest performances, achieving 31.1% in tandem (double-junction), and reaching 37.9% and 38.8% for triple junction and quadruple-junction photovoltaics, respectively, realized under standard AM 1.5 solar ...

Organic-inorganic perovskite materials have gradually progressed from single-junction solar cells to tandem (double) or even multi-junction (triple-junction) solar cells as all-perovskite tandem solar cells ...

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