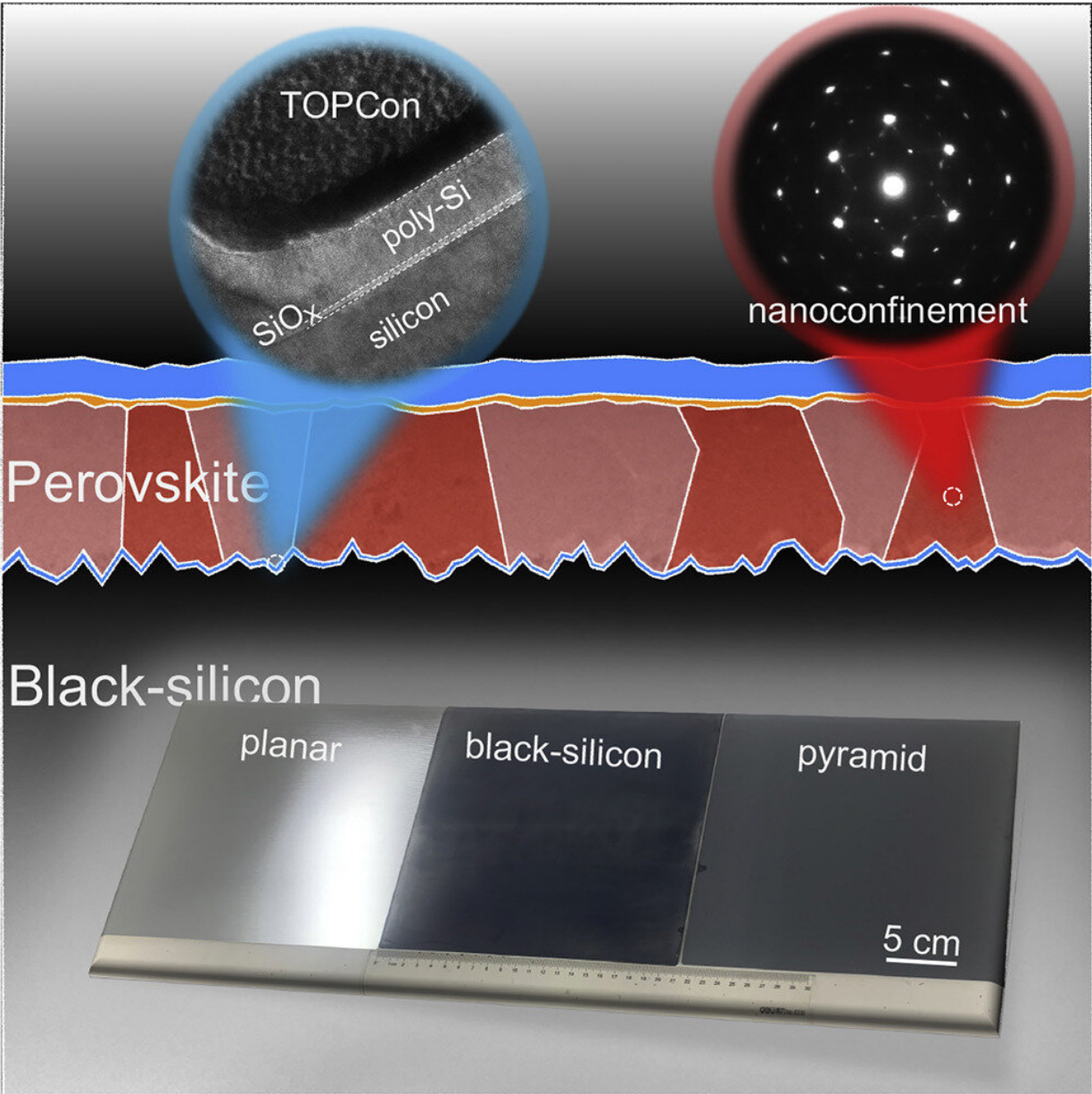


# Scientists develop high-efficiency monolithic perovskite/black silicon TOPCon tandem solar cells

October 19 2022, by Zhang Nannan



The monolithic perovskite/black silicon TOPCon tandem solar cells. Credit: NIMTE

A research group led by Prof. Ye Jichun at the Ningbo Institute of Materials Technology and Engineering (NIMTE) of the Chinese Academy of Sciences (CAS) has developed high-performance monolithic perovskite/black silicon (b-Si) solar cells with a tunnel oxide passivated contact (TOPCon), achieving a certified power conversion efficiency (PCE) of 28.2%. Results were published in *Joule*.

Perovskite/silicon tandems offer a promising pathway to increase the PCE of solar cells with relatively low cost, and are thus predicted as an emerging focus in the field of high-efficiency solar cells. However, most reported monolithic perovskite/silicon tandems either suffer from [high costs](#) and limited light trapping, or have trouble in achieving high-quality perovskite films, leading to a great challenge in optimizing the performance of perovskite/b-Si solar cells.

To address this issue, the researchers developed the first monolithic perovskite/Si [tandem](#) solar cells based on industry-relevant b-Si with TOPCon structures.

Combined with the TOPCon, the surface reconstruction of the b-Si contributes to an excellent trade-off between high-level surface passivation and broadband light trapping.

The reconstructed nanotexture of b-Si can significantly increase the moisture resistance and promote the wetting of perovskite. In addition, the b-Si guides the vertically aligned crystal growth of perovskite

through nanoconfinement effect, reducing carrier recombination and facilitating carrier collection. Moreover, b-Si alleviates the film strains, thus improving the stability of the device.

With an open-circuit voltage of 1.80 V, fill factor of 81.8%, and a short-circuit [current density](#) of 19.2 mA/cm<sup>2</sup>, the prepared monolithic perovskite/b-Si TOPCon tandem solar cells yield a remarkably high certified PCE of 28.2%, which is among the highest reported values for perovskite/Si solar cells with either TOPCon or double-side-textured Si to date.

The novel strategy in this work can shed light on the development and fabrication of high-performance perovskite/b-Si tandem [solar cells](#).

**More information:** Zhiqin Ying et al, Monolithic perovskite/black-silicon tandems based on tunnel oxide passivated contacts, *Joule* (2022). [DOI: 10.1016/j.joule.2022.09.006](https://doi.org/10.1016/j.joule.2022.09.006)

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