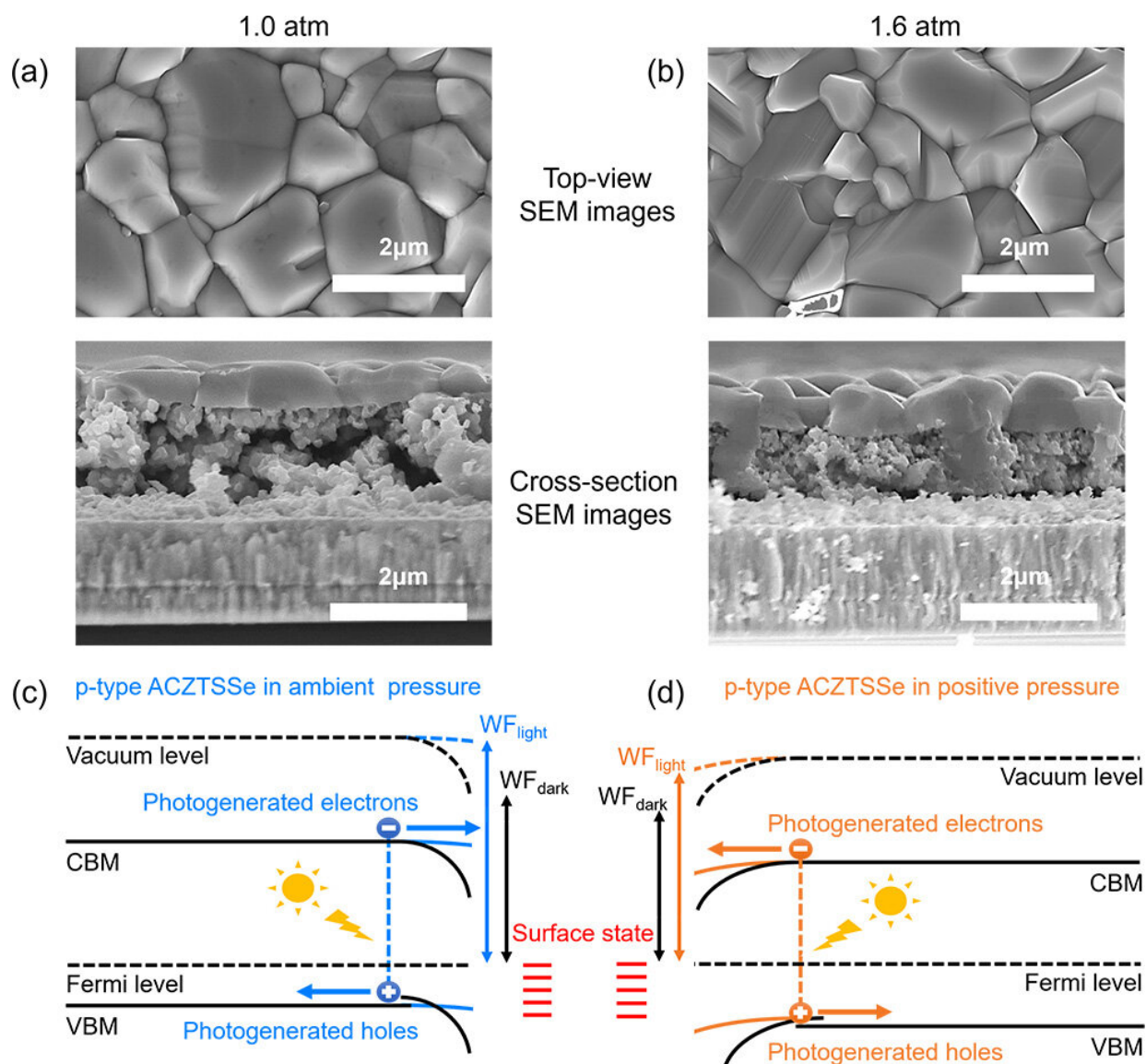


Researchers realize 13.8% certified efficiency of kesterite solar cells

April 17 2023, by Li Yuan



Morphologies and band alignments of kesterite absorbers under ambient pressure

and positive pressure. Credit: IOP

A research group led by Prof. Meng Qingbo from the Institute of Physics (IOP) of the Chinese Academy of Science (CAS) and Prof. Xin Hao from Nanjing University of Posts and Telecommunications has reported 13.8% certified efficiency of emerging kesterite solar cells. The study was published in *Nature Energy* on April 13.

Kesterite $\text{Cu}_2\text{ZnSn}(\text{S}, \text{Se})_4$ (CZTSSe), as one of the most competitive thin-film [photovoltaic materials](#), exhibits attractive advantages such as earth-abundant elemental reserves, optimal bandgaps for photovoltaic (PV) technology, and high stability.

Currently, CZTSSe solar cells show [power conversion efficiency](#) (PCE) of 13% based on environmentally friendly solution systems. However, large open-circuit voltage deficit still restricts further enhancement of device performance, primarily due to high deep-level defects in CZTSSe absorber.

In this study, the researchers regulated kinetic process of CZTSSe phase [evolution](#) by controlling positive chamber pressures. Under positive chamber pressures, the phase evolution process could be delayed to high temperature ($> 400^\circ\text{C}$). Additionally, it would avoid complex phase evolution pathways and harmful secondary phases, and achieve high crystalline CZTSSe absorber with fewer defects. The kesterite solar cell presented 14.1% PCE (total area) and a certified 13.8% PCE (total area), which is the highest result so far.

The researchers applied modulate transient photovoltage/photocurrent measurement to investigate the carrier dynamics process of kesterite solar cells. They found that under a positive chamber pressure, the bulk

defects were reduced by around one order of magnitude, and back interface contact property was improved as well.

This study provides insights into the selenization mechanism of kesterite absorbers and explores a new way of kinetic regulation strategy to simplify the [phase](#) evolution path to efficient kesterite [solar cells](#).

More information: Jiazheng Zhou et al, Control of the phase evolution of kesterite by tuning of the selenium partial pressure for solar cells with 13.8% certified efficiency, *Nature Energy* (2023). [DOI: 10.1038/s41560-023-01251-6](#)

Provided by Chinese Academy of Sciences

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