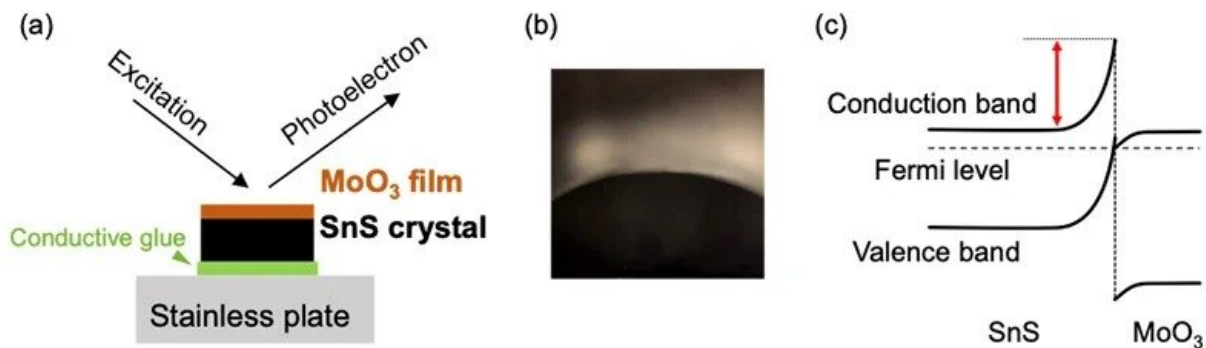


# Large band bending at SnS interface opens door for highly efficient thin-film solar cells

December 2 2022



(a) A schematic of the interface between the SnS single crystal/MoO<sub>3</sub> thin film analyzed in this study. (b) A sample actually used for the photoelectron spectroscopy measurement. Several single crystals are fixed on a stainless-steel plate. (c) A schematic energy band diagram of the present interface where SnS band exhibited large bending. Credit: Issei Suzuki et al.

Tin sulfide (SnS) solar cells have shown immense promise in the rush to develop more environmentally friendly thin-film solar cells. Yet for years SnS solar cells have struggled to achieve a high conversion efficiency. To overcome this, a SnS interface exhibiting large band bending was necessary, something a research group has recently achieved.

With the push towards carbon neutrality growing, and as a worrying

trend of rising temperatures and [natural disasters](#) caused by [global warming](#) continues, [solar cells](#) will play a pivotal role in the world's transition to renewable energy.

Now, a research group has laid the path for achieving higher open-circuit voltage in tin sulfide (SnS) solar cells, thus realizing their latent potential as a thin-film solar material.

Thin-film solar cells, which comprise compound semiconductors with strong light absorption, require less raw materials, making them lighter and cheaper to produce.

SnS is one such thin-film solar cell material with environmentally friendly credentials, since it contains no rare or toxic elements. Yet, in recent years, researchers have begun to question this premise since, despite more than 20 years of research into them, their conversion efficiency had reached a mere 5% due to a low open-circuit voltage.

The group, which was led by Assistant Professor Issei Suzuki, from Tohoku University's Institute of Multidisciplinary Research for Advanced Materials, successfully demonstrated a SnS interface exhibiting large band bending—something necessary for obtaining a higher open-circuit voltage.

"We used [photoelectron spectroscopy](#) to analyze the electronic structure of the interface where molybdenum oxide was deposited on a SnS [single crystal](#)," said Suzuki. "We confirmed that the interface state achieved a high open-circuit voltage."

This is not Suzuki's first breakthrough in SnS thin-film solar cells either. In December 2021, he led another group that produced the world's first n-type SnS thin film. This enabled homojunctions to be formed in thin films.

For the current research, the group also proposed a method for fabricating interfaces suitable for SnS thin-film solar cells, including reducing the sulfur deficiency in the SnS thin films and employing a homojunction structure in their [n-type](#) and p-type layers.

"In the near future, we hope to fabricate homojunction solar cells with high conversion efficiency," added Suzuki.

Details of the group's research were published in *The Journal of Physical Chemistry C*.

**More information:** Issei Suzuki et al, Avoiding Fermi Level Pinning at the SnS Interface for High Open-Circuit Voltage, *The Journal of Physical Chemistry C* (2022). [DOI: 10.1021/acs.jpcc.2c04212](https://doi.org/10.1021/acs.jpcc.2c04212)

Provided by Tohoku University

Citation: Large band bending at SnS interface opens door for highly efficient thin-film solar cells (2022, December 2) retrieved 11 December 2023 from <https://techxplore.com/news/2022-12-large-band-sns-interface-door.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.