N-type conductive tin sulfide thin films for environmentally friendly solar cells

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The world's first n-type conductive SnS thin film without containing toxic elements. Credit: Issei Suzuki et al.

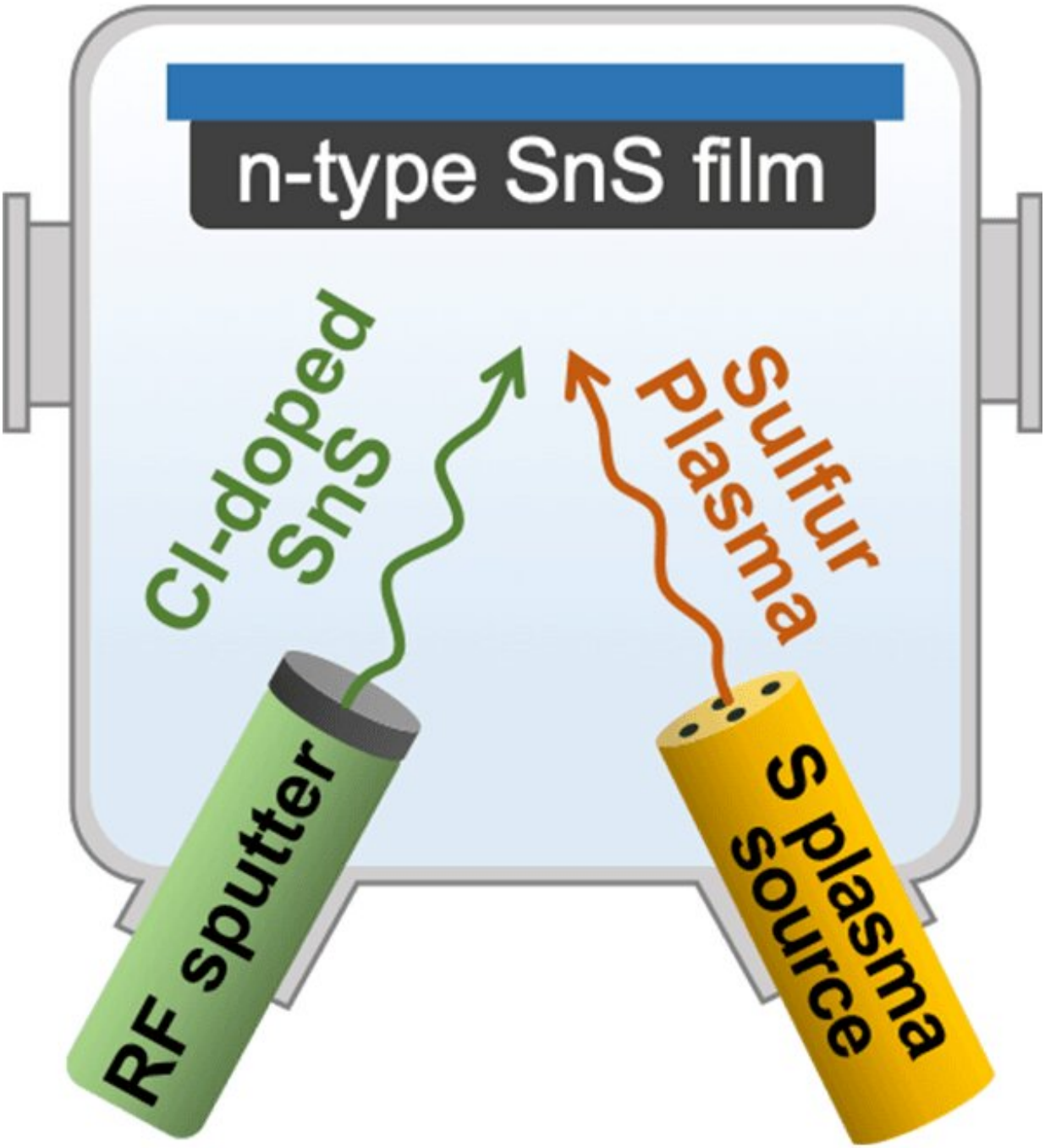
Tin sulfide (SnS) is an abundant, safe, and environmentally friendly solar cell material. This inexpensive material is forecast to be used in next-generation solar cell panels.

A research group led by Issei Suzuki and Sakiko Kawanishi, assistant professors at Tohoku University's Institute of Multidisciplinary Research for Advanced Materials, has fabricated n-type conductive SnS thin films by impurity doping for the first time.

Conventional SnS thin films are usually p-type conductive. Thus, SnS thin-film solar cells have been fabricated using a pn heterojunction with p-type SnS thin film and other n-type semiconductor thin films, such as CdS. However, the conversion efficiency of such heterojunction devices has stagnated at approximately 5%, rendering their use impractical.

The SnS thin-film solar cells employing a pn homojunction, which uses SnS thin films for both p-type and n-type layers, is expected to exhibit higher conversion efficiency. Yet, n-type conducive SnS thin films without toxic elements have never been achieved before.

Using chlorine-doping and a sulfur plasma supply, the research group reduced the lattice defects inhibiting the n-type conversion of SnS, realizing the world's first n-type SnS thin films without toxic elements.



A schematic illustration of the new technique used to fabricate n-type SnS thin films. The n-type conductive SnS thin films were achieved by fabricating thin films of chlorine(Cl)-doped SnS with a supply of sulfur plasma. Credit: Issei Suzuki et al.

"Our realization paves the way for practical pn homojunction SnS thin-film solar cells," said Suzuki.

The results of the research were published in *Physical Review Materials* on December 9, 2021.

More information: Issei Suzuki et al, n -type electrical conduction in SnS thin films, *Physical Review Materials* (2021). DOI: 10.1103/PhysRevMaterials.5.125405

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