

## Facile Synthesis of SnS-SnS<sub>2</sub> Heterostructure p-n Diode

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### Abstract

After the discovery of graphene and its extraordinary physical properties, other two-dimensional layered materials are also highlighted to become promising candidates for future nanotechnology. Sn-sulfides are one of the interesting layered materials which have different crystal phases such as hexagonal SnS<sub>2</sub> and orthorhombic SnS. These two materials show different properties such as SnS<sub>2</sub> showing n-type whereas SnS showing p-type. Recently individual growth and artificial stacking of these two materials have been demonstrated [1].

In this work, by simply removing sulfur atoms from the top part of as-exfoliated SnS<sub>2</sub> single crystal, we could achieve a facile method to synthesize SnS(p-type) and SnS<sub>2</sub>(n-type) vertical heterostructure. To confirm our method, we conducted Raman, TEM, and XPS measurements and showed that the crystal is indeed a heterostructure. Furthermore, we fabricated Graphene-SnS<sub>2</sub>-SnS-Graphene vertical p-n diode to confirm rectifying behavior and photoresponse of the device.

### References

[1] JH Ahn *et al.*, *Nano Lett.*, **15** (2015) 3703.

### Figures