Preparation of 2D Antimonene Nanosheets via Topochemical Reduction Conversion

Sheng'en Qiu, Xiaoying Li and Zongping Chen*

State Key Laboratory of Silicon and Advanced Semiconductor Materials, School of Materials Science and Engineering, Zhejiang University, Hangzhou 310027, China

*E-mail: chenzp@zju.edu.cn

1. Experimental Section

1.1 materials

SbI_3 (99.0%) and $NaBH_4$ (99.99%) were purchased from Shanghai Aladdin Biochemical Technology Co., Ltd. Fluorophlogopite mica and silicon wafers were obtained from Nanjing MKNANO Technology Co., Ltd.

1.2 Characterization of the materials

TEM analysis was conducted on a JEOL JEM-F200 instrument operating at an accelerating voltage of 200 kV for microstructure characterization.

GI-XRD measurements were performed on a Rigaku SmartLab SE diffractometer using Cu Kα radiation (λ = 0.154 nm) for phase composition analysis.

XPS characterization was carried out on a Thermo Scientific K-Alpha spectrometer equipped with a monochromatic Al Kα excitation source (1486.69 eV) for chemical state analysis.

OM observations were made using a Nikon Eclipse LV1000D microscope for morphological examination.

Raman spectroscopy was performed on a WITec Alpha 300R system to probe the intrinsic vibrational modes of the crystal.

2. Supplementary Figures

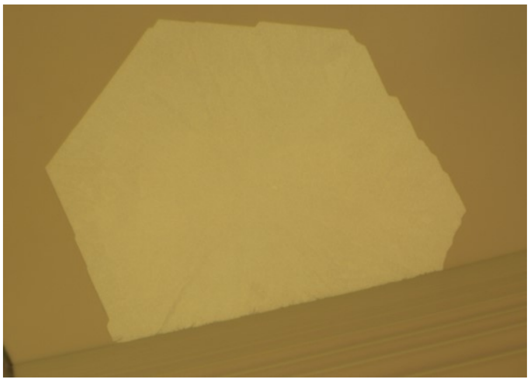

Figure. S1 OM image of antimonene after reduction

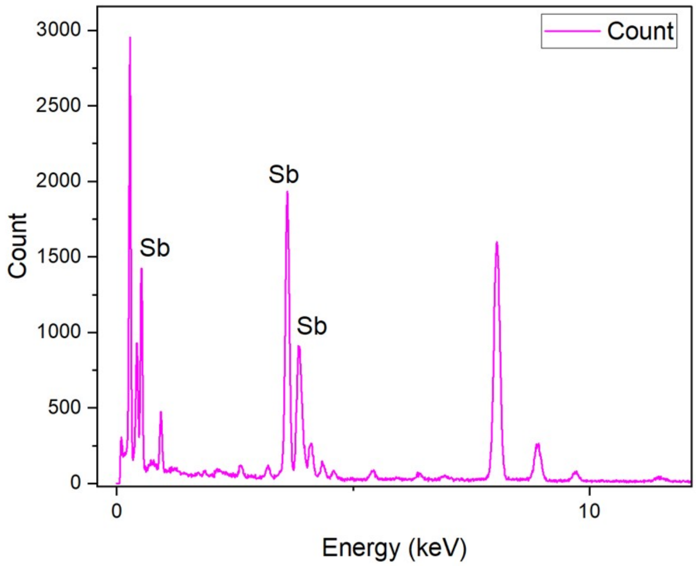

Figure. S2 EDS spectrum of antimonene nanosheets.

Figure. S3 FFT of antimonene nanosheets.

Table S1 Quantitative analysis

Element	Mass (%)	Atom (%)
Sb	100	100
I	0	0

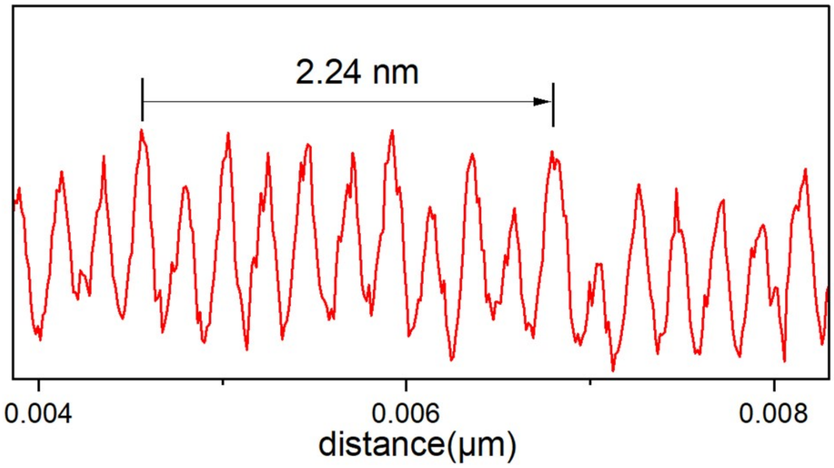

Figure. S4 The TEM lattice spacing of antimonene

Table S2 Comparison of different synthesis methods for antimonene

Methods	Synthesis temperature (°C)	Lateral size and shape (μm)	Synthesis atmosphere	Reference
CVD	660-750	<10, hexagon	Ar	1, 2
Liquid-phase exfoliation	25	<5, irregular	Air	3, 4
Wet-chemical synthesis	300	<3, hexagon	Ar	5, 6
Topochemical Reduction Conversion	**110**	**~50, hexagon**	**Air**	**This work**

References:

1. Q.-T. Zhang, Y.-T. Tseng, K.-C. Lu, C.-W. Huang, H.-F. Hsu and W.-W. Wu, *Scripta Materialia*, 2023, **226**, 115262.
2. J. Ji, X. Song, J. Liu, Z. Yan, C. Huo, S. Zhang, M. Su, L. Liao, W. Wang, Z. Ni, Y. Hao and H. Zeng, *Nat Commun*, 2016, **7**, 13352.
3. X. Wang, J. He, B. Zhou, Y. Zhang, J. Wu, R. Hu, L. Liu, J. Song and J. Qu, *Angew Chem Int Ed Engl*, 2018, **57**, 8668-8673.

4. F. Zhang, J. He, Y. Xiang, K. Zheng, B. Xue, S. Ye, X. Peng, Y. Hao, J. Lian, P. Zeng, J. Qu and J. Song, *Adv Mater*, 2018, **30**, e1803244.
5. L. Peng, S. Ye, J. Song and J. Qu, *Angew Chem Int Ed Engl*, 2019, **58**, 9891-9896.
6. I. Torres, M. Alcaraz, R. Sanchis-Gual, J. A. Carrasco, M. Fickert, M. Assebban, C. Gibaja, C. Dolle, D. A. Aldave, C. Gómez-Navarro, E. Salagre, E. García Michel, M. Varela, J. Gómez-Herrero, G. Abellán and F. Zamora, *Advanced Functional Materials*, 2021, **31**, 2101616