Electronic Supplementary Material (ESI) for Nanoscale.

Surface band bending caused by native-oxides on solution-processed twinned InSb nanowires with p-type conductivity

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Table S1. The parameters of XRD test.

target	measurement	sample form	detector	geometry	software	expected resolution
copper	Bragg	powder	2D	10 μm	highscore plus	±0.0001°

Table S2. The parameters of XPS test.

XPS analyzer	excitation source	photon energy	number of scans	software	expected resolution
Perkin-Elmer ESCALAB 250	monochromatic Al K_α radiation	1486.68 eV	5	Avantage	0.1 eV

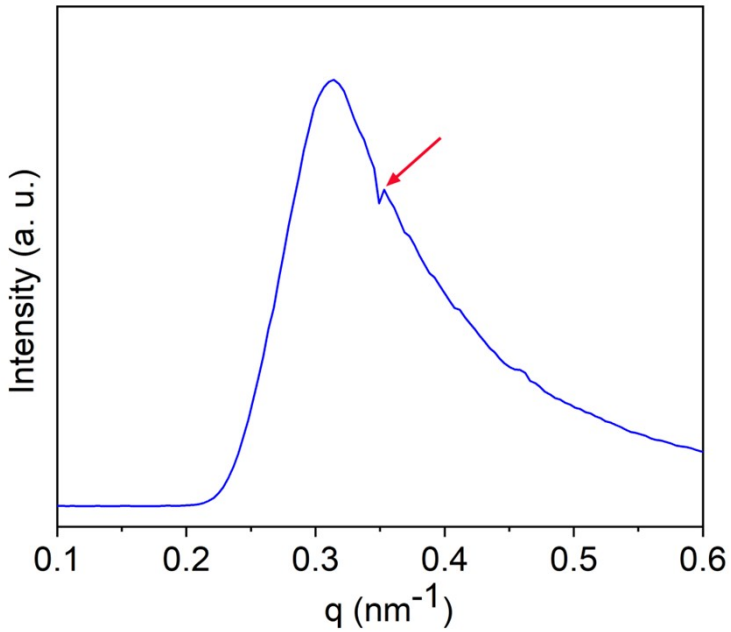

Figure S1. Small angle X-ray scattering (SAXS) detection of the as-obtained InSb NWs. The SAXS pattern detects that the pseudoperiodicity is of d = 177.85 Å (at q = 0.3531 nm^{-1}, d = 2π/q = 17.785 nm).

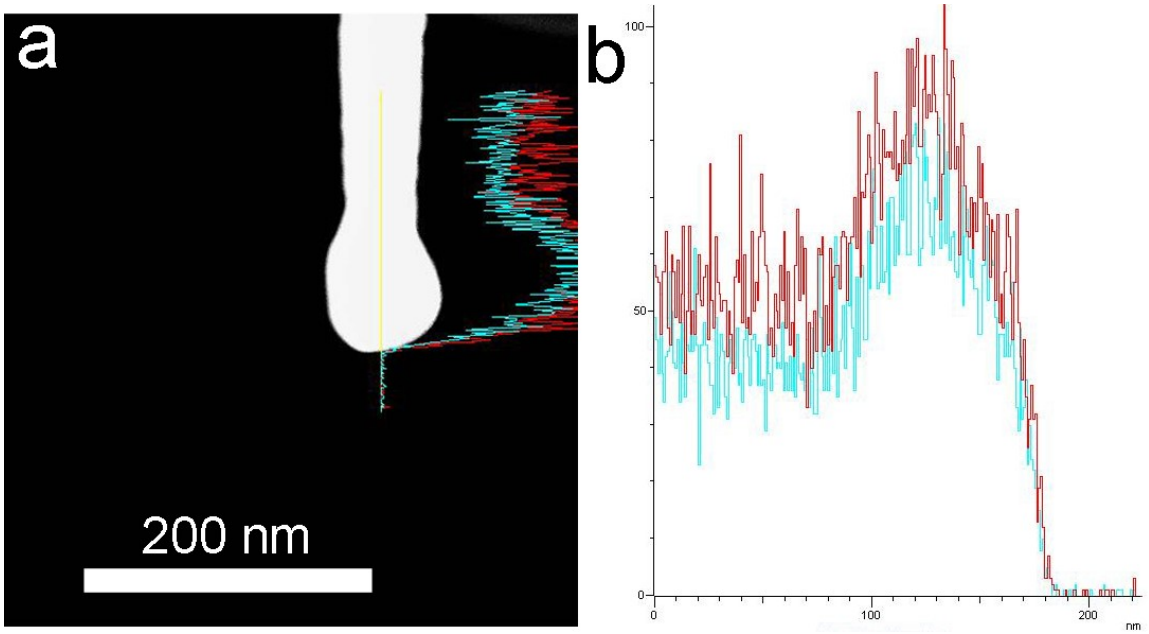

Figure S2. (a) STEM-EDX line scan of the single InSb nanowire, and (b) magnified line-scan profile,red and cyan lines represent In and Sb elements, respectively.

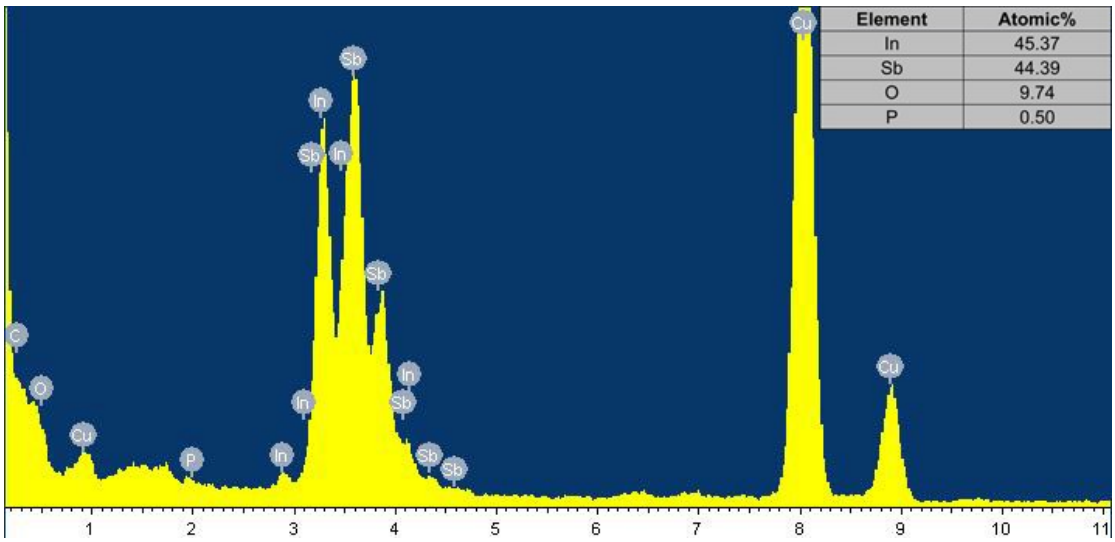

Figure S3. EDX spectra of InSb nanowire.

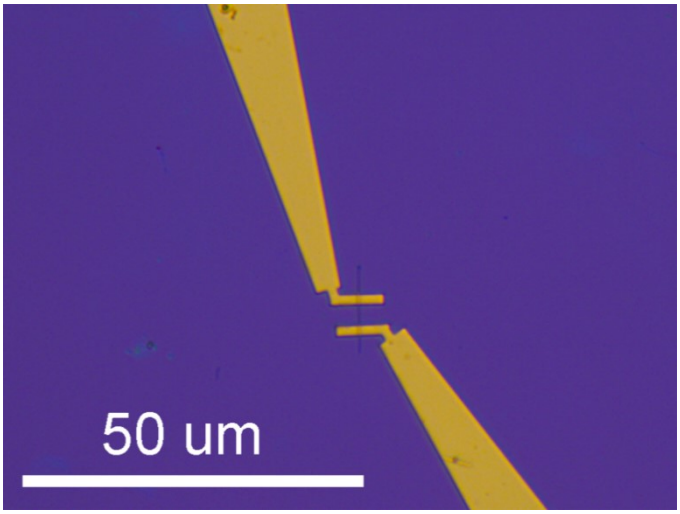

Figure S4. The microscope image of the as-fabricated single NW-based device.

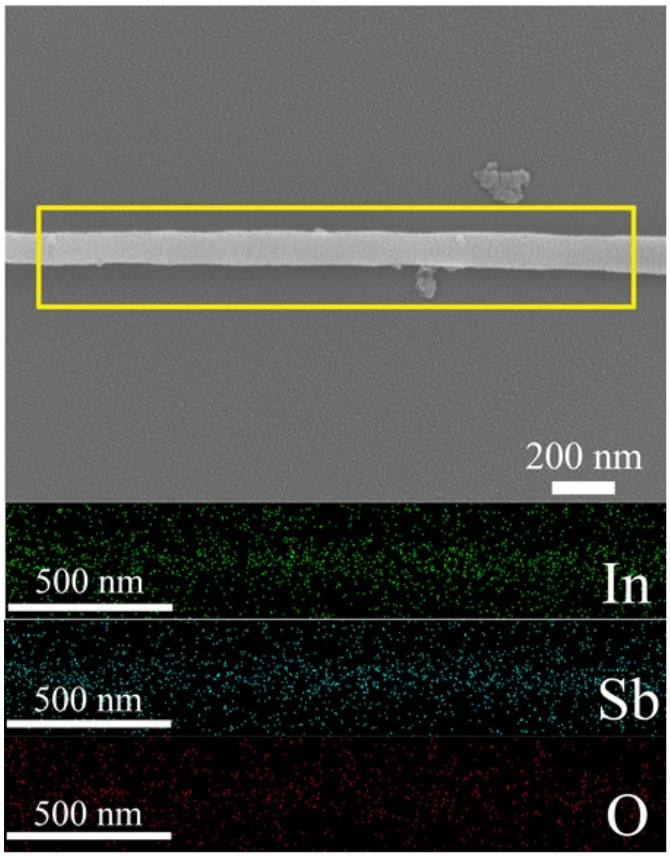

Figure S5. SEM image of NW after testing and corresponding elemental mapping. The area of elemental mappings is consistent with the yellow box in the STEM image.

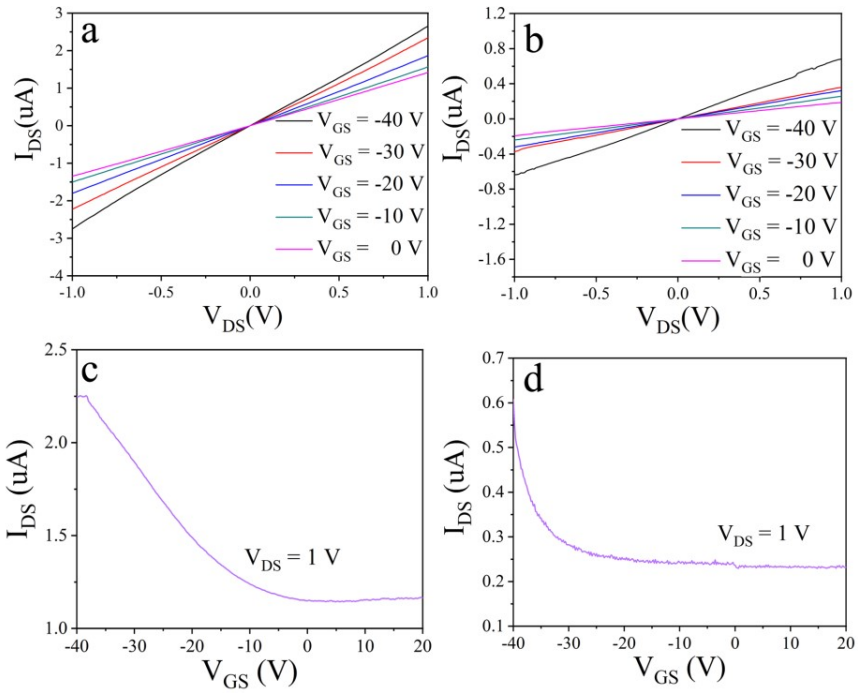

Figure S6. (a,b) I_{DS}-V_{DS} curves at varied gate voltages after 5 and 20 days of air exposure, respectively. (c,d) I_{DS}-V_{GS} curves at V_{DS} = 1 V with p-type characteristic after 5 and 20 days of air exposure, respectively.

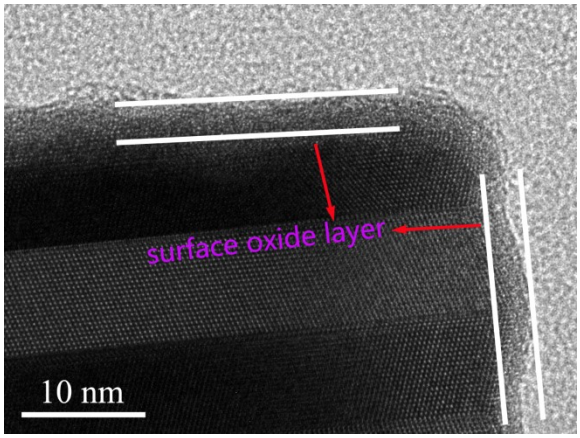

Figure S7. HRTEM image of an individual InSb nanowire after air exposure for 20 days.

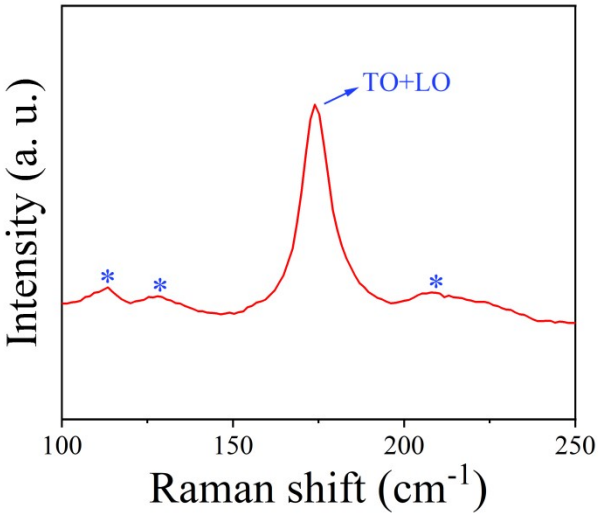

Figure S8. Raman spectroscopy of the InSb NWs detected at room temperature. The peak located at around 174 cm^{-1} corresponds to the transverse-optical (TO) and longitudinal-optical (LO) phonon mode of InSb NWs.[1,2] The peaks emerging at about 114, 130, and 212 cm^{-1} (labeled with *) were ascribed to surface oxide layers composed of the oxidation states of In and Sb.[3,4]

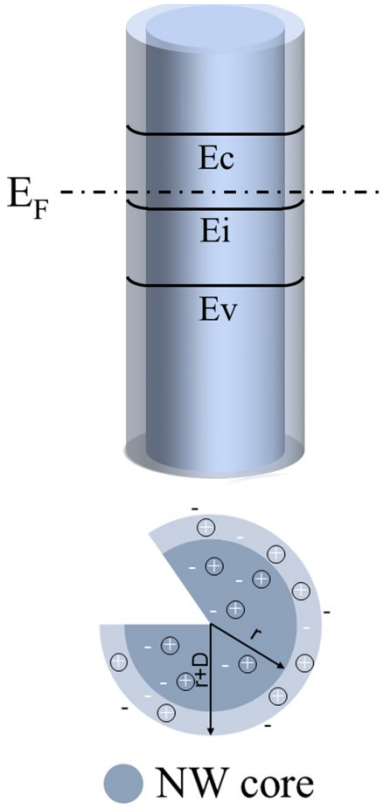

Figure S9. Schematic illustration of single NW with extremely thin oxide layer. The InSb NW contains a NW core and a native-oxides layer. E_I, E_C, E_V, and E_F represent the intrinsic Fermi energy level, conduction band minimum, valence band maximum and actual Fermi energy level, respectively. D and r represent the thickness of native-oxides layer and the diameter of NW core.

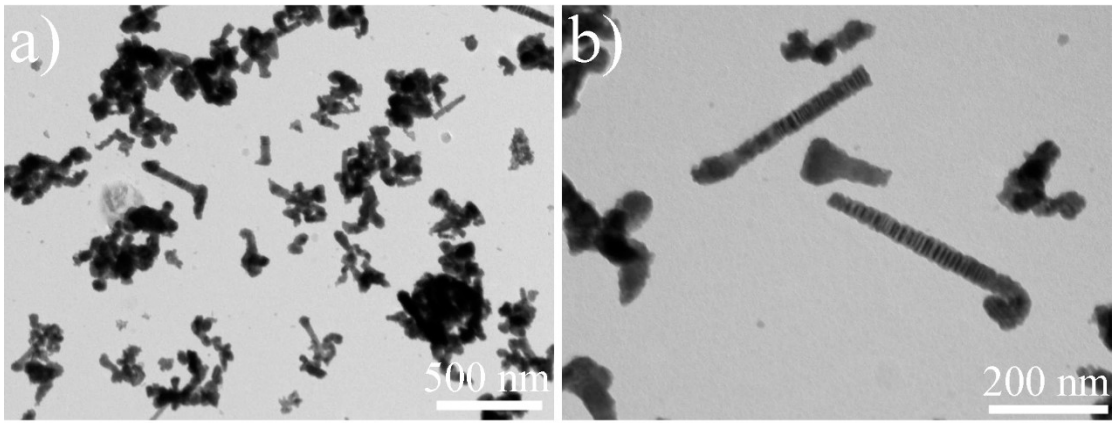

Figure S10. Low (a) and magnified (b) TEM images of HF-treated sample.

Supplementary references.

(1) Y. Y. Qian and Q. Yang, *Nano Lett.*, 2017, **17**, 7183–7190.

(2) H. Potts, M. Friedl, F. Amaduzzi, K. C. Tang, G. Tutuncuoglu, F. Matteini, E. Alarcon Llado, P. C. McIntyre and A. F. I. Morral, *Nano Lett.*, 2016, **16**, 637–643.

(3) W. H. Wang, X. S. Wang, Z. G. Ma, Y. Wang, Z. X. Yang, J. X. Zhu, L. Lv, H. Ning, N. Tsubaki and M. B. Wu, *Acs Catal.*, 2023, **13**, 796–802.

(4) Y. Li, S. Chu, H. Shen, Q. Xia, A. W. Robertson, J. Masa, U. Siddiqui and Z. Sun, *ACS Sustainable Chem. Eng.*, 2020, **8**, 4948–4954.