Supplementary Material

Pressure-induced superconductivity in $SnSb_2Te_4$

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Supplementary Note 1： ***The comparison of the in situ high pressure synchrotron XRD results of the potential decomposition products***

The interference of the potential decomposition products, such as Te, SnTe, and Sb_2Te_3, has vital impact on the validity of the results in this work. Fortunately, the in situ high pressure synchrotron XRD results of these interference materials have been reported previously (Refs. [1], [2] and [3]) by our group and are ready for comparison. As shown in figure, all the observed d-spacings in the present work can be unambiguously assigned to $SnSb_2Te_4$. They can be explicitly distinguished from those of Te (figure S1), SnTe (figure S2), and Sb_2Te_3 (figure S3). Thus the decomposition of $SnSb_2Te_4$ into Te, SnTe, and Sb_2Te_3, can be ruled out credibly.

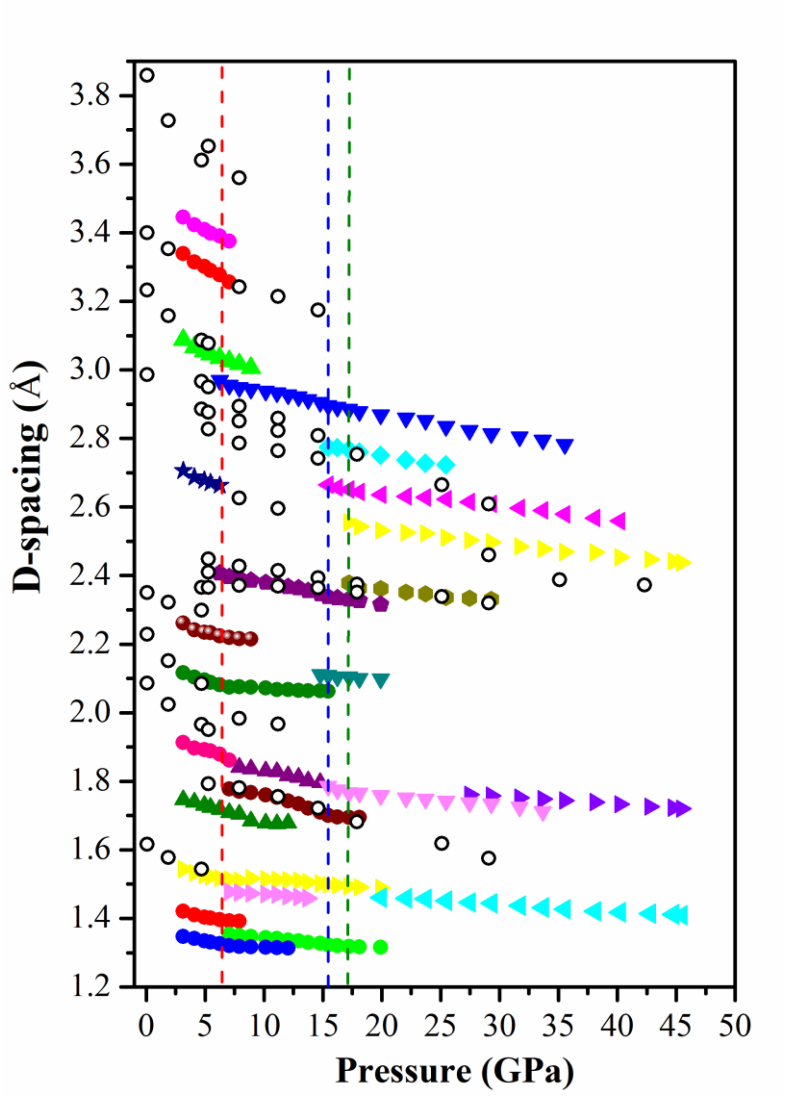

Figure S1. The pressure dependent lattice-spacings of $SnSb_2Te_4$ and Te [1]. The solid symbols and open circles corresponding to the lattice-spacings of $SnSb_2Te_4$ and Te, respectively. The existing regions of the identified phases for $SnSb_2Te_4$ are labeled in the figure. Around transition pressure, some slopes exhibit abrupt changes.

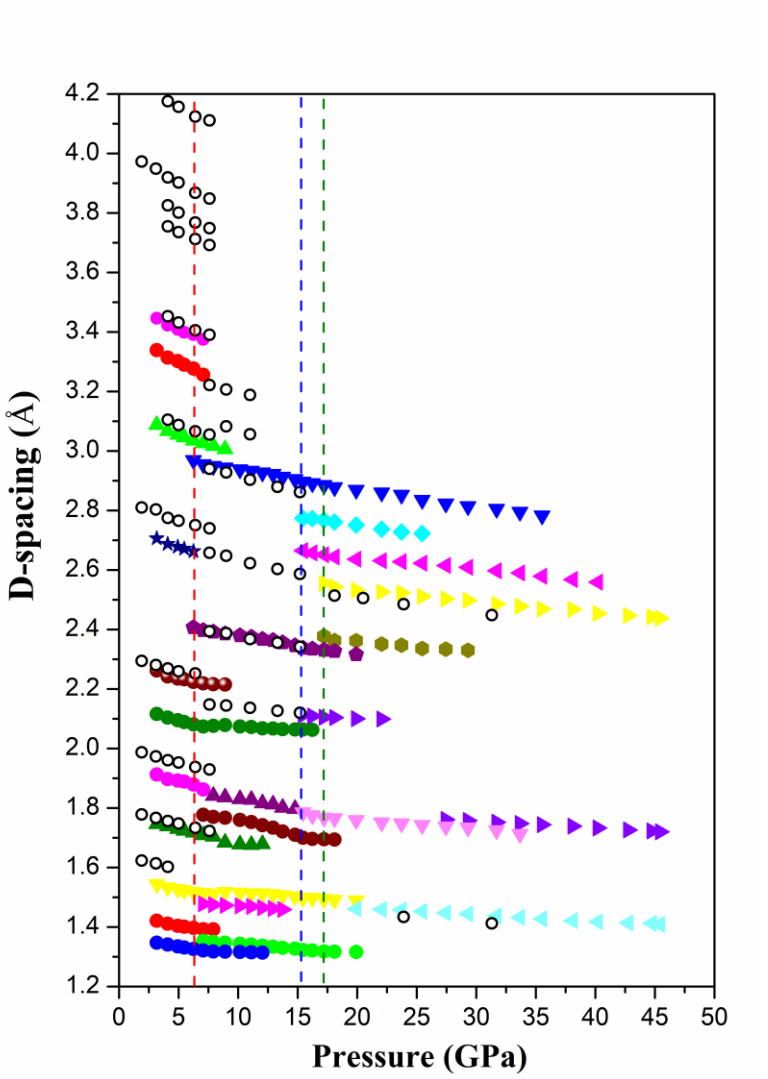

Figure S2. The pressure dependent lattice-spacings of $SnSb_2Te_4$ and SnTe [2]. The solid symbols and open circles corresponding to the lattice-spacings of $SnSb_2Te_4$ and SnTe, respectively.

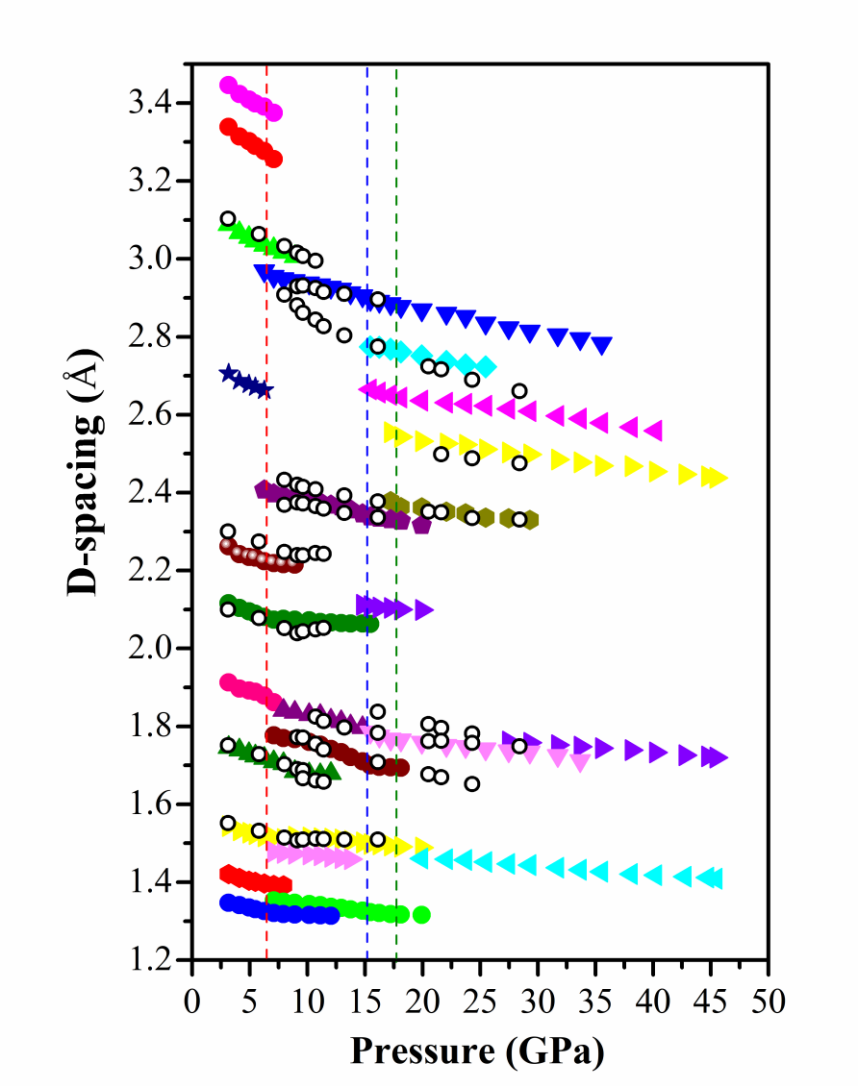

Figure S3. The pressure dependent lattice-spacings of $SnSb_2Te_4$ and Sb_2Te_3 [3]. The solid symbols and open circles corresponding to the lattice-spacings of $SnSb_2Te_4$ and Sb_2Te_3, respectively.

References:

[1] X. Li, X. Huang, X.Wang, M. Liu, G. Wu, Y. Huang, X. He, F. Li, Q. Zhou, B.Liu and Tian Cui, High-pressure dissociation of selenium and tellurium, Phys.Chem. Chem.Phys. 20, (2018) 6116

[2] D.Zhou, Q.Li, Y.Ma, Q. Cui, and C. Chen, Unraveling Convoluted Structural Transitions in SnTe at High Pressure, J. Phys. Chem. C 117 (2013) 5352

[3] Y. Ma, G. Liu, P. Zhu, H. Wang, X. Wang, Q. Cui, J. Liu, Y. Ma, Determinations of the high-pressure crystal structures of Sb_2Te_3, J Phys Condens Matter. 24 (47) (2012) 475403

Supplementary Note 2：

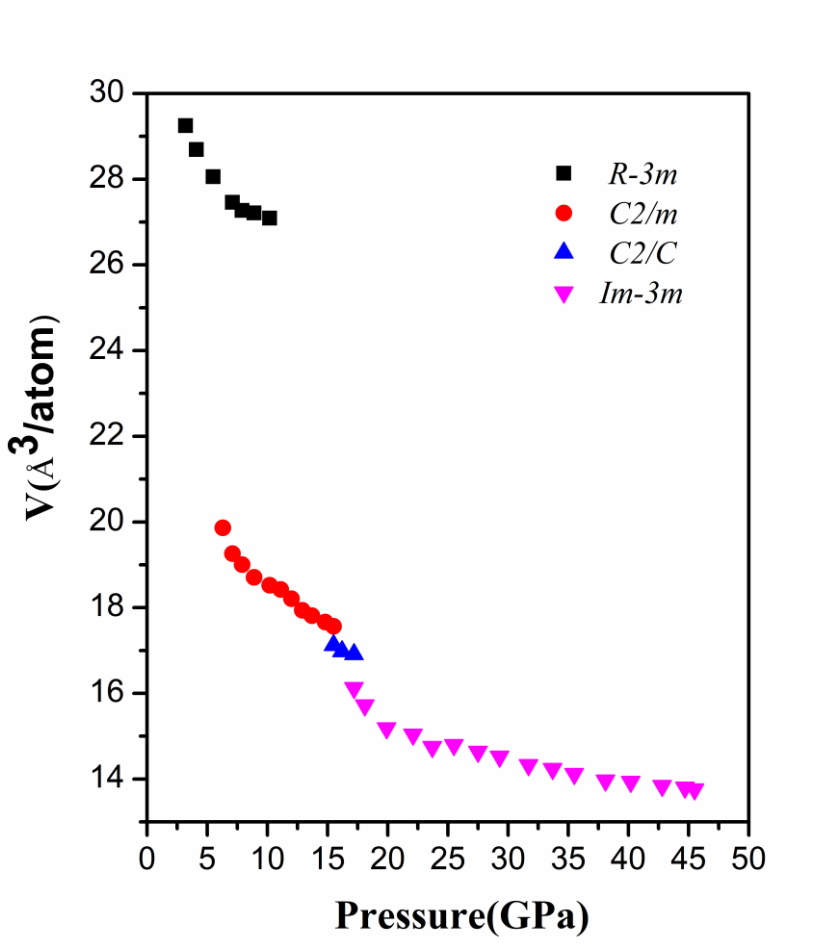

Figure S4. Pressure dependence of the volume per atom $SnSb_2Te_4$ under compression. Obvious volume drops are evidenced to characterize the first order I→ II→ III→ IV.

Table S1. The comparison of *Tc* and critical pressures of $SnSb_2Te_4$ with several topological superconductor candidates

Topological Materials	Pressure [GPa]	T_c [K]	Maximum T_c [K]	
$SnSb_2Te_4$	12.3 GPa	5.2 K	8.2 K	This work
Sb_2Te_3	4.0 GPa	3.0 K	7.3 K	Ref.9
$SnBi_2Te_4$	16.1 GPa	6.5 K	8.9K	Ref.15
$SnSb_2Te_4$	8.1 GPa	2.1K	7.4K	Ref.22
$GeSb_2Te_4$(a-GST)			6.0 K	Ref.25
$GeSb_2Te_4$(c-GST)			8.0 K	Ref.25