Superconductivity in Pristine 2H_a-MoS_2 at Ultrahigh Pressure

Z. H. Chi[1]*

[1] *Key Laboratory of Materials Physics, Institute of Solid State Physics, Chinese Academy of Sciences, Hefei 230031, People's Republic of China*

Keywords: superconductivity, transition metal dichalcogenides, diamond anvil cell

*e-mail: zhchi@issp.ac.cn

We extend pressure beyond the megabar range to seek after superconductivity in the 2*H*a-MoS2 via electrical transport measurements. We found that superconductivity emerges with an onset critical temperature Tc of ca. 3 K at ca. 90 GPa. Upon further increasing the pressure, Tc is rapidly enhanced beyond 10 K and stabilized at ca. 12 K over a wide pressure range up to 220 GPa. Synchrotron x-ray diffraction measurements evidenced no further structural phase transition, decomposition, and amorphization up to 155 GPa, implying an intrinsic superconductivity in the 2*H*a-MoS2. DFT calculations suggest that the emergence of pressure-induced superconductivity is intimately linked to the emergence of a new flat Fermi pocket in the electronic structure. Our finding represents an alternative strategy for achieving superconductivity in 2*H*-MoS2 in addition to chemical intercalation and electrostatic gating.

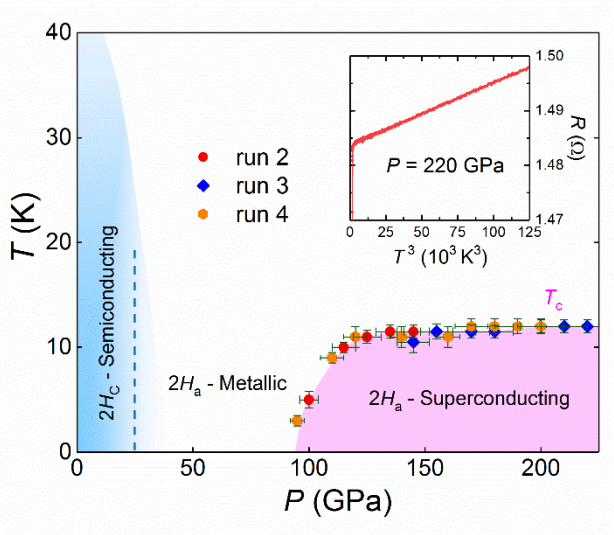

Figure 1. Pressure-temperature phase diagram of MoS_2.

Acknowledgments: This work was supported by the National Natural Science Foundation of China (Grant Nos. 51372249, 11674328, 11374307, 11650110430, 11774140, 11474280, 11404343, 11534003, U1632275).

[1] Z. -H. Chi, X. L. Chen, F. Yen, F. Peng, Y. H. Zhou, J. L. Zhu, Y. J. Zhang, X. D. Liu, C. L. Lin, S. Q. Chu, Y. C. Li, J. G. Zhao, T. Kagayama, Y. M. Ma, and Z. R. Yang, Phys. Rev. Lett. 120, 037002 (2018)