Transport at the superconductor-normal junction in ionic gated MoS_2

Qihong CHEN [1], Ali Abdurrahman El YUMIN[1], and Jianting YE[1]

[1] *Device Physics of Complex Materials, Zernike Institute for Advanced Materials, University of Groningen, the Netherlands*

Molybdenum disulfide (MoS_2) is a layered material similar to graphene that can be thinned down to a few atomic layers. Along with the superior electronic and optical properties that are promising for ultrathin electronic devices, applying strong field effect on MoS_2 can dope this intrinsic semiconductor into a superconductor [1-4]. In this study, we focus on the electrical transport properties at the superconductor-normal (SN) interface made on the surface of ionic gated few-layer MoS_2, either by partially covering the surface of MoS_2 with an h-BN flake or contacting with a normal metal. The magnetoresistance at the SN interface shows a non-monotonic behaviour, signifying the Andreev reflection as a function of the energy barrier height, the superconducting gap and the electron energy [5]. From the differential conductance measurement, we can extract the superconducting gap using the Blonder-Tinkham-Klapwijk (BTK) model [6]. The behaviour of the superconducting gap as a function of carrier density and electric field is discussed.

References

[1] J. T. Ye, Y. J. Zhang, R. Akashi, M. S. Bahramy, R. Arita, and Y. Iwasa, Science 338, 1193 (2012).
[2] J. M. Lu, O. Zheliuk, I. Leermakers, N. F. Q. Yuan, U. Zeitler, K. T. Law, and J. T. Ye, Science 350, 1353 (2015).
[3] Q. H. Chen, J. M. Lu, L. Liang, O. Zheliuk, A. Ali, P. Sheng, and J. T. Ye, Phys. Rev. Lett. 119, 147002 (2017).
[4] Q.H. Chen, J.M. Lu, L. Liang, O. Zheliuk, A. A. E. Yumin, and J. Ye, Adv. Mater. 30, 1800399 (2018).
[5] Q.H. Chen, L. Liang, A. Ali El Yumin, J.M. Lu, O. Zheliuk, and J. Ye, Phys. Status Solidi B 00, 1700181 (2017).
[6] D. Costanzo, H. Zhang, B. A. Reddy, H. Berger, and A. F. Morpurgo, Nat. Nanotechnol. 13, 483 (2018).

E-mail: Qihong.Chen@rug.nl