Superconductivity in Monolayer FeTe on Bi_2Te_3

V. Tkáč,[1,2] S. Vorobiov,[2] P. Baloh,[2] M. Vondráček,[3] G. Springholz,[4] K. Carva,[1] P. Szabó,[5] Ph. Hofmann,[6] and J. Honolka[3]

[1] *Department of Condensed Matter Physics, Faculty of Mathematics and Physics, Charles University, Ke Karlovu 5, CZ-12116 Prague 2, Czech Republic*

[2] *Institute of Physics, Faculty of Science, P. J. P. J. Šafárik University, Park Angelinum 9, 041 54, Košice, Slovakia*

[3] *Institute of Physics, Academy of Sciences of the Czech Republic, Na Slovance 2, CZ-18221 Prague 8, Czech Republic*

[4] *Institute of Semiconductor and Solid State Physics, Johannes Kepler University, Altenbergerstrasse 69, 4040 Linz, Austria*

[5] *Institute of Experimental Physics, Slovak Academy of Sciences, Watsonova 47, 040 01 Košice, Slovakia*

[6] *Department of Physics and Astronomy, Interdisciplinary Nanoscience Center (iNANO), Aarhus University, 8000 Aarhus C, Denmark*

The temperature and magnetic field dependence of electric transport indicates a superconducting (SC) ground state in monolayer (ML) thin FeTe on Bi_2Te_3, while respective $FeSe/Bi_2Se_3$ samples remain in a normal state at temperatures $T \geq 1$ K. Strong indications for superconductivity presence were previously observed by scanning tunneling spectroscopy [1,2]. The samples were grown in UHV by molecular beam epitaxy and were characterized by X-ray and UV photoemission spectroscopy as described in Ref.[3]. A protective amorphous silicon layer was added for subsequent *ex-situ* transport measurements. Zero-field transport data reveals characteristic drops in resistance at critical temperatures T_c, which depend on the magnetic field and FeTe coverage on Bi_2Te_3. For ~ 1 ML FeTe, the zero-field transition appears at $T_c \sim 2.8$ K and increases to $T_c \sim 5.8$ K for ~ 2 ML. Out-of-plane critical fields are extracted to be $\mu_0 H_{C2} \approx 0.3$ T and 2.2 T, respectively. The observed temperature dependence of the critical fields is discussed in terms of the presence of 60° rotated FeTe island domains on Bi_2Te_3 of varying width in the range of (50 ± 30) nm. For larger islands, we show that critical fields are dominated by orbital pair breaking.

References:

[1] A. Eich et al., Phys. Rev. B 94, 125437 (2016).
[2] S. Manna et al., Nature Communications 8, 14074 (2017).
[3] J. Fikáček et al., New Journal of Physics 22, 073050 (2020).

This work was supported by the Czech Science Foundation (Grant 376 No. 19-13659S) and by the Slovak Research and Development Agency Projects numbers APVV-18-0197, APVV-20-0324 and APVV-20-0425.