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Andreev Reflection Investigation of FeSe by Soft Point-Contact Spectroscopy

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Since the discovery of superconductivity in FeSe, this compound has been intensively investigated. FeSe belong to the family of the iron-based superconductors (IBS) and it has the simplest crystal structure among the IBS. It does not demonstrate a long range magnetic order in comparison to other IBS, what can somewhat simplify understanding the nature of the superconducting (SC) pairing. In this context the investigation of SC gap(s) in FeSe gets priority status.

We present the study of the SC gaps in FeSe single crystal (T_C = 9K) [1] using soft point-contact Andreev-reflection (AR) spectroscopy [2]. Soft PCs were formed by putting of a small drop of silver paste on the cleaved surface of the sample.

The measured dV/dI curves are typically shown the AR double minima structure around zero bias along with the background of the semiconducting behavior at the larger bias. The double minima structure vanishes by approaching to the critical temperature or in magnetic field that specifies their SC origin.

Fitting of the AR structure by the two-gap BTK model results in the SC gap values Δ_S~1meV and Δ_L~2meV, with the about 80% contribution to the conductivity coming from the large gap Δ_L. These results lead to an evidence for the multi-band superconductivity in the FeSe compound. No additional features in dV/dI spectra that testify the gapless superconductivity or presence of a much smaller gap than presented ones were observed. The temperature dependence of the SC gaps differ from the expected BCS behavior, especially it concerns the magnetic field dependence of the gap, where the gap value is almost field independent, while all AR structures gradually vanishes with a field. The reasons of such behavior are under further examination.

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1. *D. Chareev*, et al., CrystEngComm. **15**, 1989 (2013).
2. *Yu.G. Naidyuk and I. K.Yanson*, Point-Contact Spectroscopy (New York: Springer, 2005).