EXCESS CONDUCTIVITY IN FeAs-BASED SUPERCONDUCTOR $EuFeAsO_{0.85}F_{0.15}$

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The discovery of high-T_c superconductivity in FeAs-based compounds (Fe-pnictides) [1] has stimulated a great burst of research activity . Following the discovery in LaFeAs(O,F) with T_c=26 K[1], superconductivity was found in many materials with related crystal structures, that commonly possess iron-pnictide or iron-chalcogenide layers. Actually the various members of the iron containing FePn's can be divided into three main family of materials, which show superconducting (SC) transition upon substitution by a dopant or upon applying external pressure[1].

The study of excess conductivity $\sigma'(T)$ in the textured polycrystalline FeAs-based superconductor $EuFeAsO_{0.85}F_{0.15}$ (Tc = 11 K) prepared by the solid state synthesis is reported for the first time. The $\sigma'(T)$ analysis has been performed within the local pair (LP) model based on the assumption of the LPs formation in cuprate high-Tc superconductors (cuprates) below the pseudogap (PG) temperature $T^* >> T$c [2]. Similarly to the cuprates, near Tc $\sigma'(T)$ is adequately described by the 3D term of the Aslamasov–Larkin (AL) theory but the range of the 3D-AL fluctuations, ΔT_{3D}, is relatively short. Above the crossover temperature T_0 =11.7 K $\sigma'(T)$ is described by the 2D Maki–Thompson (MT) fluctuation term of the Hikami–Larkin theory. But enhanced 2D-MT fluctuation contribution being typical for the magnetic superconductors is observed. Within the LP model the PG parameter, $\Delta^*(T)$, was determined for the first time. It is shown that $\Delta^*(T)$ demonstrates the narrow maximum at Ts » 160 K followed by the descending linear length down to $T_{SDW}=T_{NFe}$=133 K [2]. Observed small ΔT_{3D}, enlarged 2D $\sigma'(T)$ and linear $\Delta^*(T)$are considered to be the evidence of the enhanced magnetic interaction in $EuFeAsO_{0.85}F_{0.15}$. Importantly, the slop of the linear $\Delta^*(T)$ and its length are found to be the same as it is revealed for $SmFeAsO_{0.85}$. The results suggest both the similarity of the magnetic interaction processes in different Fe-pnictides and applicability of the LP model to the $\sigma'(T)$ analysis even in magnetic superconductors.

[1] M V Sadovskii, High-temperature superconductivity in iron-based layered iron compounds, Phys.—Usp. 51 1201-1227.
[2] A. L. Solovjov Superconductors - Materials, Properties and Applications. Chapter 7: Pseudogap and local pairs in high-T_c superconductors, Rijeka.,137 (2012).