Highlights

Superconductivity - 2016

Thermoelectric properties of iron-based superconductors and parent compounds

I. Pallecchi, F. Caglieris and M. Putti

CNR-SPIN and Università di Genova, Dipartimento di Fisica, Via Dodecaneso 33, 16146 Genova, Italy

Topical Review in Supercond. Sci. Technol. 29, 073002 (2016)

We review experimental data of thermoelectric transport properties of iron-based superconductors and parent compounds. We discuss possible Seebeck effect mechanisms into play, from whence one can extract information about Fermi surface reconstruction and Lifshitz transitions, multiband character, coupling of charge carriers with spin excitations, nematicity, quantum critical fluctuations close to the optimal doping for superconductivity, correlation. Additional information is obtained from the Nernst effect, whose enhancement in parent compounds must be related partially to multiband transport and low Fermi level, but mainly to the presence of Dirac cone bands at the Fermi level. In the superconducting compounds, large Nernst effect in the normal state is explained in terms of fluctuating precursors of the spin density wave state, while in the superconducting state it mirrors the usual vortex liquid dissipative regime. A comparison between the phenomenology of thermoelectric behavior of different families of iron-based superconductors and parent compounds allows to evidence the key differences and analogies.

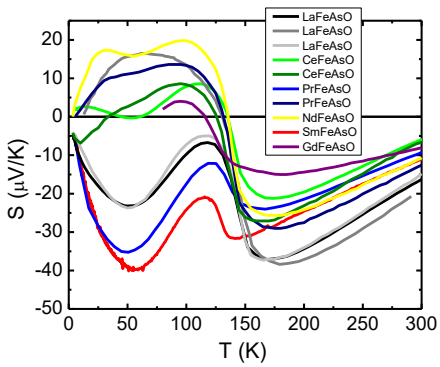

Figure 1. Seebeck coefficient curves of REFeAsO (RE=La, Ce, Pr, Nd, Sm, Gd) polycrystals taken from literature, exhibiting diffusive and phonon drag regimes.

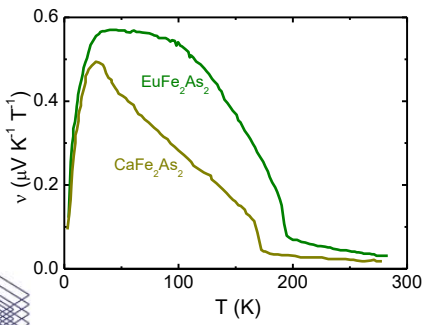

Figure 2. Nernst effect curves measured in 122 parent compounds $EuFe_2As$ and $CaFe_2As_2$ single crystals, exhibiting anomalous enhancement attributed to the formation of Dirac cones in the electronic structure.

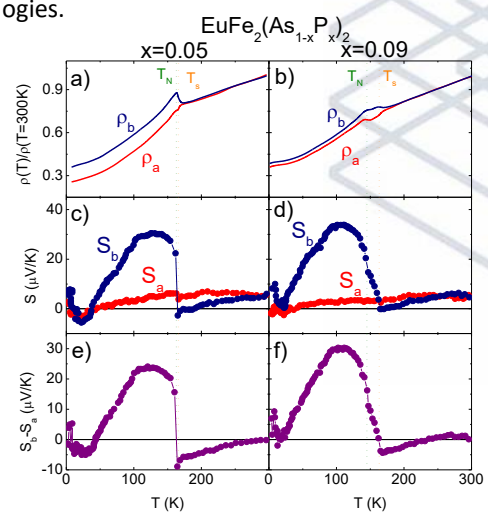

Figure 3. Nematicity in of $EuFe_2(As_{0.95}P_{0.05})_2$ and $EuFe_2(As_{0.91}P_{0.09})_2$ single crystals: electrical resistivity (a,b) and Seebeck coefficient (c,d) along the orthorhombic a and b axes, and temperature dependences of the Seebeck coefficient anisotropy (S_b-S_a) (e,f).