Abstract submitted to the
ARW Workshop on Correlated Thermoelectrics:
Properties and Applications of Thermoelectric Materials
September 20 - 26, 2008 Hvar, Croatia

Enhanced Thermoelectricity in the Correlated Semiconductor $FeSb_2$

Peijie Sun[1], Niels Oeschler[1], Simon Johnsen[2], Bo Brummerstedt Iversen[2], Frank Steglich[1]

[1] *Max Planck Institute for Chemical Physics of Solids, Nöthnitzer Straße 40, 01187 Dresden, Germany*
[2] *Department of Chemistry, University of Aarhus, Langelandsgade 140, 8000 Aarhus C, Denmark*

Submitted : 31-08-2008
Keywords : strong correlations, thermopower, Nernst effect

Recently, $FeSb_2$ was classified as a new *d*-electron based correlated semiconductor [1], similar to the unique FeSi. The discoveries of a colossal thermopower amount to $S = 45\,\mathrm{mV/K}$ and a huge thermoelectric power factor of $\mathrm{PF} = S^2/\rho = 2300\,\mu\mathrm{W/K^2cm}$ [2] near 10 K stimulate us to study the physics of the thermoelectricity enhancement and its possibility as practical thermoelectric material for low temperature cooling. In this work, we measure the thermoelectric properties of a mew $FeSb_2$ single crystal prepared by chemical vapor transport technique, and make a comparison with the Ru-based homologue $RuSb_2$. Thermodynamic properties show strong indications of correlation effects in the former, while they are absent in the latter. Enhanced thermopower with a peak in excess of $10\,\mathrm{mV/K}$ was observed below $\sim$30 K, in agreement with the previous report [2]. Together with a relatively small electrical resistivity, this leads to a large thermoelectric power factor, $650\,\mu\mathrm{W/K^2cm}$. On the other hand, $RuSb_2$ shows less enhanced thermopower with small power factor. Nernst coefficient is also enhanced in $FeSb_2$ in the same temperature range, however, showing a very different temperature dependence from thermopower. We argue that the enhanced thermoelectricity in $FeSb_2$ is due to the electron-electron correlation effects which are absent in $RuSb_2$. Analysis based on classical models will also be presented, which shows that the dominating term in the enhanced thermopower in $FeSb_2$ is indeed electronic in origin.

[1] C. Petrovic *et al.*, Phys. Rev. B **72** 045103 (2005), Phys. Rev. B **67** 155205 (2003).
[2] A. Bentien *et al.*, Europhys. Lett. **80** 17008 (2007).