THERMOELECTRIC PROPERTIES OF MPt_4Ge_{12} (M=Sr,Ba,Eu)

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Cage-forming compounds such as zeolithes, fullerenes, clathrates or skutterudites have proven to be not only of scientific but also of significant technological interest. The ability of these materials to accommodate guest filler species provides a wide range of varying physical and chemical properties. Hitherto, cage forming elements of skutterudites are essentially based on volatile and/or toxic pnictogens (P, As, Sb). We report on the characterisation of $SrPt_4Ge_{12}$, $BaPt_4Ge_{12}$ and $EuPt_4Ge_{12}$ as the first members of a new class of skutterudites, based on a framework, entirely formed by Ge-atoms. By ab initio modelling, we provide evidence that (i) the filler atoms stabilize the Pt_4Ge_{12} skutterudite framework; (ii) most remarkably, the density of states at the Fermi energy is dominated by Ge 4p states. Below Tc = 5.35 K, and 5.1 K for $BaPt_4Ge_{12}$ and $SrPt_4Ge_{12}$, respectively, an electron-phonon coupled superconducting state emerges, while a magnetic phase transition occurs below 1 K in the case of $EuPt_4Ge_{12}$

The aim of the present work is to discuss the present understanding of these novel materials from a variety of experimental studies and DFT calculations. Moreover, we show the temperature dependences of the electrical resistivity, thermal conductivity and thermopower of these compounds, in order to test their thermoelectric performances.

[1] E. Bauer et al., Phys. Rev. Lett., **99** (2007) 217001.
[2] E. Bauer et al., J. Phys. Soc. Japan (2008) in press.

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