ThermoBuild Brief

A Newsletter Featuring Leading Voices in Thermoelectrics and Building Energy Technology

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Research Highlights

The main scope of our research activities is currently to develop new materials with beneficial properties for thermoelectricity, either used in thermoelectric generators or for cooling purposes at low temperatures. We have recently performed a series of screening studies to identify such materials, using methods where the most important mechanisms of electron and phonon scattering were included. This led to the prediction of some very interesting materials, including CsK_2Sb (zT up to 2.8) and Na_2TlSb (zT up to 4.4). While both contain problematic elements, important insight can be drawn from detailed studies of what makes them so promising.

Expert Spotlight

Ole Martin Løvvik

Chief Research Scientist at SINTEF Materials Physics; Professor at University of Oslo, Norway

Technical Insight

- The promising materials above feature electronic band structures resembling those of low-dimensional materials: CsK_2Sb exhibits tubular energy isosurfaces akin to two-dimensional systems, while Na_2TlSb has box-like isosurfaces like those of one-dimensional nanowires.
- The beneficial effect of such band structures was confirmed by detailed analyses of the electron transport properties, including various electron scattering mechanisms. This revealed several conflicting processes, with a net positive outcome for the two materials in focus. The detailed analysis of electron scattering was crucial to reach this insight.

Data Snapshot

Thermoelectric transport of strained CsK_2Sb: Role of electron velocities and scattering within extended Fermi surfaces, *Phys. Rev. B* ***111****, 195205 (2025),* Ø. A. Grimenes, G. J. Snyder, O. M. Løvvik, and K. Berland,

Exceptional thermoelectric properties in Na_2TlSb enabled by quasi-1D band structure, *Phys. Rev. B (In press), arXiv:2506.22167 (2026).* Ø. A. Grimenes, O. M. Løvvik, and K. Berland

The papers were an important part of Øven Grimenes' PhD thesis, published in 2025.

Up Next

" We are now moving to low-temperature applications of thermoelectric materials. Since the main scattering mechanisms change when the temperature is reduced, the importance of a proper understanding of those effects is further amplified."

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