

ThermoBuild Brief

A Newsletter Featuring Leading Voices in Thermoelectrics and Building Energy Technology

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Research Highlights

Our recent research focuses on advancing thermoelectric (TE) materials and devices, from understanding heat and charge transport to developing materials and modules with controlled interfaces. We recently investigated the oxidation behavior of commercial Half-Heusler alloys and successfully integrated them into high-power-density TE generators. In parallel, our work on $\text{Bi}_{0.4}\text{Sb}_{1.6}\text{Te}_3$ challenges the conventional view that melt-spinning enhances thermoelectric performance primarily by strongly reducing lattice thermal conductivity. By directly measuring thermal conductivity under high magnetic fields, we uncovered anomalously low Lorenz numbers, revealing unexpected deviations from the conventional Wiedemann–Franz law and providing new insights into charge and heat transport in TE materials.

Expert Spotlight



[Bertrand Lenoir](#)

Professor, Institut Jean Lamour, Université de Lorraine, Nancy, France

Technical Insight

- The Lorenz number is commonly estimated from the Wiedemann–Franz law, which links electronic thermal and electrical conductivity.
- Our measurements show that this conventional relationship breaks down in $\text{Bi}_{0.4}\text{Sb}_{1.6}\text{Te}_3$, with unexpectedly low Lorenz numbers whose magnitude and temperature dependence cannot be explained by standard transport models.
- The finite-temperature deviation points to inelastic electron–electron and electron–phonon scattering processes that relax charge and heat currents differently. These findings provide a new perspective on thermal transport in TE materials.

Data Snapshot

“Hidden in Plain Heat: Anomalous Lorenz Number in the Thermoelectric Alloy $\text{Bi}_{0.4}\text{Sb}_{1.6}\text{Te}_3$ ”, *Nature Communications*, 16, 11528 (2025), Candolfi, C., Wiendlocha, B., Ohorodniichuk, V. et al. <https://doi.org/10.1038/s41467-025-66578-y>

“Oxidation Behavior and Integration into High Power Density Thermoelectric Generators of Commercial Half-Heusler Alloys”, *ACS Applied Materials & Interfaces*, 17, 40773–40787 (2025). El Oualid, S., Masschelein, P., Aranda, L. et al. <https://doi.org/10.1021/acsami.5c08992>

Up Next

“One of our next research activities will focus on identifying and developing Half-Heusler alloys based on non-toxic, abundant, and low-cost elements. We will combine ab initio calculations with artificial intelligence and machine-learning approaches to screen promising compositions, predict their thermoelectric performance, and accelerate the discovery of new materials for sustainable thermoelectric applications.”



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