

ThermoBuild Brief

A Newsletter Featuring Leading Voices in Thermoelectrics and Building Energy Technology

Issue #4 | June, 2026

Research Highlights

Over the past year, our research has focused on advanced thermoelectric materials, including argyrodites, β -tungsten-type compounds, and structurally complex intermetallic phases such as Nowotny chimney–ladder compounds. We study how crystal structure, chemical bonding, and atomic-scale disorder govern heat and charge transport. Using extreme-condition synthesis, advanced characterization, local thermoelectric imaging, and electronic-structure calculations, we aim to establish predictive structure–property relationships between bonding inhomogeneity, lattice dynamics, electronic structure, and transport properties. For designing high-performance energy-conversion materials and deepen our understanding of structure–property relationships in complex solids.

Expert Spotlight



Krzysztof T. Wojciechowski

Professor and Head of the
Thermoelectric Research
Laboratory, AGH University
of Science and Technology,
Kraków, Poland

Technical Insight

- Recent studies indicate that bonding inhomogeneity may serve as a useful descriptor linking crystal chemistry with thermal transport. Variations in local bond strength create a broad distribution of vibrational environments, enhancing phonon scattering while preserving favorable electronic transport pathways.
- Applying this concept has enabled the development of several new thermoelectric materials exhibiting figures of merit exceeding $ZT = 1.2$ at temperatures below 600 K, a range particularly relevant for low-grade waste-heat recovery.
- These results demonstrate how crystal-chemical design can simultaneously advance fundamental understanding and accelerate the development of practical TE technologies.

Data Snapshot

Structure–Property Relations of the Nowotny Chimney–Ladder Phase Fe_2Ge_3 , *Chemistry of Materials* (submitted, 2025),

The study reveals how the unique incommensurate crystal structure of the Nowotny chimney–ladder phase Fe_2Ge_3 influences its electronic structure and heat transport. By combining crystallographic analysis, electronic-structure calculations, and thermoelectric characterization, the work provides new insights into the role of bonding inhomogeneity and structural complexity in controlling transport properties of advanced TE materials.

Up Next

"Our next goal is to translate recently developed TE materials into practical device technologies. With β -tungsten-type materials achieving a $ZT > 1.1$ @ 500K, comparable to state-of-the-art Bi_2Te_3 -based TE materials, current efforts focus on the development of TE modules, including reliable joining and contact technologies, optimization of electrical and thermal interfaces, and scalable fabrication. By combining materials design with device engineering, we aim to develop additive-manufactured TE modules capable of competing with conventional Bi_2Te_3 system for cooling and low-temperature waste-heat recovery."



Universidad
de Navarra

ThermoBuild Brief is an independent scholarly newsletter edited by Dr. Reshma Krishnan Madathil, MSCA Postdoctoral Fellow at the Universidad de Navarra. It is published under the *Building Integrated Thermoelectric System (BITES)*, project, funded by the EU HORIZON-MSCA-2024 programme (Grant No. 101208430). Contact: rmadathil@unav.es. [Subscribe to our newsletter](#)


BITES