Thermal testing device of materials under controlled electrical bias conditions

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Opportunity

Seeking a licensing and development partner to advance the device from benchtop prototype into a commercial instrument.

Development Stage

Early benchtop prototype with proof-of-concept experimental data.

Intellectual Property

Provisional Patent Application Filed

Publication

Ali Sarikhani, Gregory E. Hilmas, David W. Lipke, Douglas E. Wolfe, Stefano Curtarolo, Shen J. Dillon, Ahmad Mirzael, Yew San Hor, William G. Fahrenholtz, "Thermal Rectification in an AI/Mo/ n-Sl Schottky Heterostructure".

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PROBLEM STATEMENT

Heat transport drives the performance, reliability, and lifetime of thermoelectrics, semiconductors, batteries, ceramics, and aerospace materials. Measuring it accurately and reproducibly is essential. Yet most thermal property tests are static and conducted separately from electrical testing. They do not reflect how materials behave in real devices where heat and electricity interact. Tools like laser flash and transient plane source systems are useful but have limitations, including surface-coating artifacts, narrow Seebeck integration, and little or no bias control. Researchers are left stitching together results from separate instruments or building custom lab rigs that are not standardized and reproducible. There is a need for one bench-ready tool that measures heat transport under realistic electrical conditions.

SOLUTION

Researchers at Missouri University of Science and Technology have developed a benchtop device that combines thermal-property testing with controlled electrical bias in a single setup. A specimen sits between conductive plates. The device applies controlled heat, measures temperature differences, and adds electrical bias and voltage-measurement capabilities within a single workflow. This lets users study how heat transport changes under an electric field. In one setup, it measures thermal conductivity, thermal diffusivity, and bias-sensitive electrothermal response. The result is bias-dependent thermal testing that no longer depends on fragmented workflows or custom academic rigs.

VALUE PROPOSITION

The device closes a real measurement gap by bringing controlled-bias electrothermal testing to the benchtop. Its architecture is relatively simple, which supports manufacturability and OEM integration. It fits naturally as a licensed module, a thermal-analysis accessory, or a co-developed product with an established instrument vendor. It is well suited to electrically active materials such as thermoelectrics, semiconductors, batteries, and thermal-management materials, and it meets growing demand for better tools in electronics thermal management.