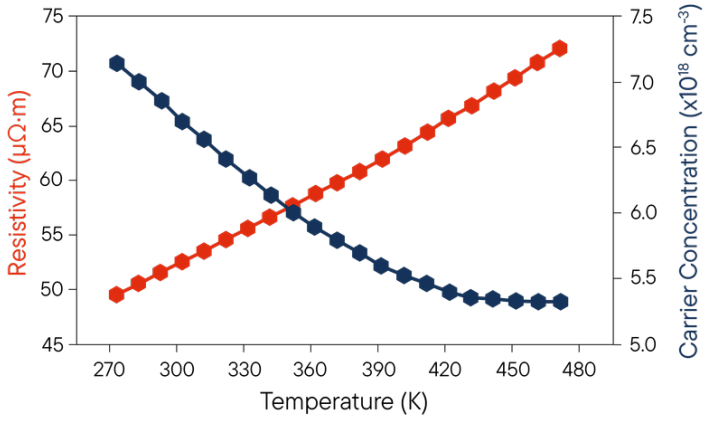
Electrical Transport Properties of ALD Sb_2Te_3 Thin Films

TFA Analysis of Temperature-Dependent Electrical Properties

Electrical transport measurements provide valuable insights into the performance of semiconductor and thermoelectric thin films. In this application example, ALD-grown Sb_2Te_3 thin films were investigated using the LINSEIS TFA L59 (former designation: Thin Film Analyzer). The measurements reveal the influence of temperature on carrier concentration and electrical transport behavior.

Measurement Setup

- Instrument: LINSEIS TFA L59 (former designation: Thin Film Analyzer)
- Sample: ALD-grown Sb_2Te_3 thin film
- Temperature Range: 273 K to 473 K
- Measurement: Resistivity and carrier concentration
- Application: Thermoelectric and semiconductor thin films



The TFA measurement reveals the temperature-dependent electrical transport behavior of the investigated Sb_2Te_3 thin film.

Key observations include:

- Resistivity increases from 49.6 to 72.2 μΩ·m
- Carrier concentration decreases from 7.2 × 10^{18} to 5.3 × 10^{18} cm^{-3}
- Continuous change of electrical properties with temperature
- Clear indication of thermally activated transport mechanisms
- Reliable characterization of semiconductor thin-film performance

The results demonstrate the suitability of the TFA L59 for evaluating temperature-dependent electrical properties and optimizing advanced thin-film materials for electronic applications.

Interpretation

The observed electrical behavior can be attributed to:

- Increased carrier scattering at elevated temperatures
- Temperature-dependent charge transport
- Thin-film specific transport effects

This results in:

- Higher electrical resistivity
- Reduced carrier concentration
- Improved understanding of transport mechanisms

Industrial Relevance

TFA measurements support:

- Semiconductor development
- Thermoelectric materials research
- Thin-film optimization
- Electronic device characterization
- Process and quality control

Conclusion

The measurements performed with the LINSEIS TFA L59 demonstrate the strong influence of temperature on the electrical transport properties of ALD-grown Sb_2Te_3 thin films. The results provide valuable information for optimizing thermoelectric materials and advanced semiconductor devices.

Source:
Yang, J., Li, J., Bahrami, A., Nasiri, N., Lehmann, S., Cichocka, M. O., Mukherjee, S., Nielsch, K. Wafer-Scale Growth of Sb_2Te_3 Films via Low-Temperature Atomic Layer Deposition for Self-Powered Photodetectors. ACS Applied Materials & Interfaces, 2022, 14(48), 54034–54043. DOI: 10.1021/acsami.2c16150
Adapted from electrical transport measurements performed using a LINSEIS Thin Film Analyzer (current designation: TFA L59).