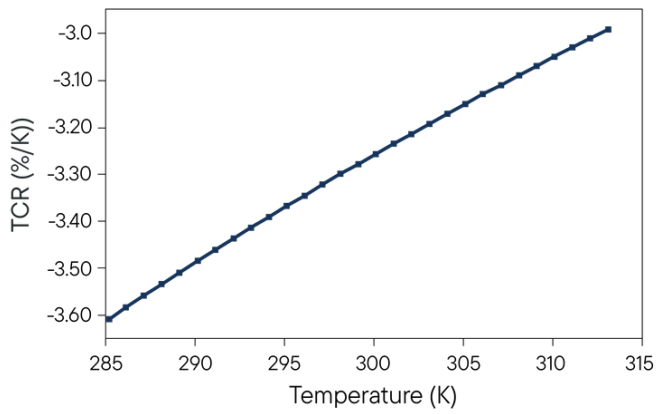
Thermal Characterization of Ge-Si-Sn-O Thin Films

TFA L59 Analysis of Temperature Coefficient of Resistance for Infrared Sensor Applications

The temperature coefficient of resistance (TCR) is one of the most important parameters for evaluating thin-film materials used in infrared sensors and microbolometers. Materials with a high absolute TCR provide enhanced sensitivity to temperature changes and therefore improved detector performance.
In this application example, Ge-Si-Sn-O thin films were investigated using the LINSEIS TFA L59. The measurements demonstrate the temperature-dependent resistance behavior of the material and its suitability for uncooled infrared sensing applications.

Measurement Setup

- Instrument: LINSEIS TFA L59
- Sample: Ge-Si-Sn-O thin film
- Temperature Range: 285 K to 314 K
- Measurement: Temperature Coefficient of Resistance (TCR)
- Application: Infrared sensors and microbolometers



The TFA measurement reveals a clear temperature dependence of the electrical resistance behavior.
Key observations include:

- TCR increases continuously from approximately −3.61 %/K to −3.00 %/K
- Nearly linear relationship between temperature and TCR
- Stable electrical response across the investigated temperature range
- High absolute TCR values suitable for infrared detection
- Excellent sensitivity to small temperature variations

The results demonstrate the suitability of Ge-Si-Sn-O thin films for highly sensitive infrared sensor applications and microbolometer development.

Interpretation

The observed behavior can be attributed to:

- Thermally activated charge transport
- Temperature-dependent carrier concentration
- Stable amorphous thin-film structure

This results in:

- High infrared sensitivity
- Reliable sensor performance
- Improved temperature detection capability

Industrial Relevance

TFA measurements support:

- Microbolometer development
- Infrared imaging systems
- Thermal sensor optimization
- Thin-film semiconductor characterization

Conclusion

The measurements performed with the LINSEIS TFA L59 demonstrate the excellent temperature-sensitive electrical behavior of Ge-Si-Sn-O thin films. The high absolute TCR values and stable temperature response highlight the material's potential for next-generation uncooled infrared detectors and thermal imaging technologies.

Source:
Vadakepurathu, F., Rana, M.
Electrical, Optical and Thermal Properties of Ge-Si-Sn-O Thin Films.
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Adapted from the temperature-dependent TCR characterization presented in Figure 11 of the original publication.