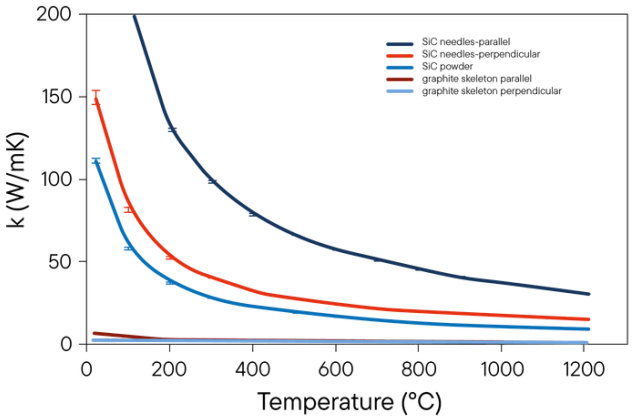
Thermal Conductivity of SiC Source Materials

LFA L52 Analysis of Morphology-Dependent Heat Transport

The thermal properties of SiC source materials play an important role in controlling temperature fields during physical vapor transport crystal growth. In this study, the LINSEIS LFA L52 was used to investigate how recrystallization, densification and structural changes influence the temperature-dependent thermal conductivity of SiC source material before and after crystal growth.

Measurement Setup

- Instrument: LINSEIS LFA L52
- Material: SiC Source Material
- Samples: SiC Powder, SiC Needles & Si-Depleted Graphite Skeleton
- Temperature Range: RT–1200 °C
- Atmosphere: Vacuum
- Measurement: Thermal Diffusivity / Thermal Conductivity
- Application: SiC Crystal Growth / Semiconductor Materials



The laser flash measurements reveal clear differences in thermal conductivity depending on the morphology and orientation of the SiC source material.

Key observations include:

- Thermal conductivity decreases with increasing temperature
- Highest conductivity for SiC needles parallel to heat flow
- Clear anisotropy of the recrystallized SiC structure
- Very low conductivity of the graphite skeleton

The results demonstrate the strong influence of structural changes on heat transport during SiC crystal growth.

Interpretation

The observed behavior can be attributed to:

- Recrystallization and densification of SiC
- Directional SiC needle and pore structures
- Silicon depletion in the graphite skeleton

This results in:

- Anisotropic thermal conductivity
- Direction-dependent heat transport
- Reduced conductivity in depleted regions

Industrial Relevance

Laser Flash Analysis supports:

- SiC single-crystal growth
- Semiconductor manufacturing
- PVT process optimization
- Thermal process simulation
- High-temperature material development
- Thermal management of growth processes

Conclusion

The LINSEIS LFA L52 enables precise characterization of morphology-dependent thermal transport in SiC source materials over a wide temperature range. The measurements demonstrate that recrystallization, densification and pore orientation significantly alter thermal conductivity during PVT crystal growth, providing valuable material data for temperature-field modeling, process optimization and controlled production of high-quality SiC single crystals.

Source:
Arzig, M., Steiner, J., Salamon, M., Uhlmann, N., Wellmann, P. J.
Influence of Morphological Changes in a Source Material on the Growth Interface of 4H-SiC Single Crystals.
Materials, 2019, 12, 2591.
Adapted from laser flash measurements performed using a LINSEIS LFA 1000 (now designated as LFA L52).