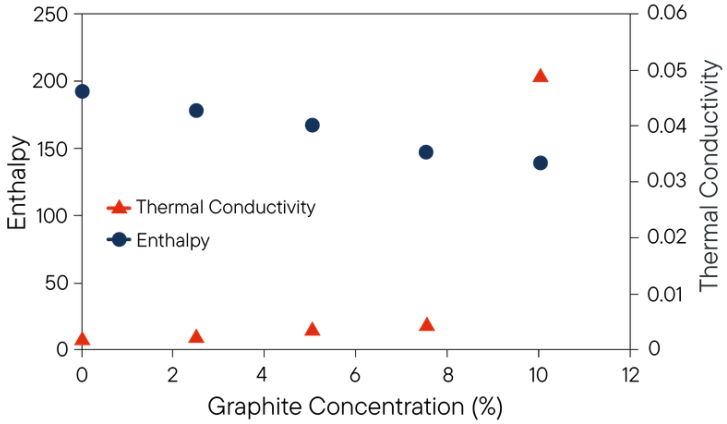
Thermal Conductivity Enhancement of Graphite-Modified Phase Change Materials

Laser Flash Analysis of Eicosane/Graphite Nano-Composite Energy Storage Materials

Laser Flash Analysis (LFA) enables the precise determination of thermal diffusivity and thermal conductivity of materials under controlled temperature conditions. In this application example, graphite nanoparticle-enhanced Eicosane phase change materials (PCM) were investigated using a Linseis LFA 51 (former LFA 500). The measurement provides valuable information about heat transfer behavior and thermal performance of advanced thermal energy storage materials.

Measurement Setup

- Instrument: Linseis LFA L51 (former designation: LFA 500)
- Sample: Eicosane PCM with varying graphite nanoparticle content (0–10 wt%)
- Temperature: 25 °C
- Measurement: Thermal diffusivity and calculated thermal conductivity
- Application: Thermal energy storage materials (PCM)



The LFA measurement reveals the influence of graphite nanoparticle content on the thermal conductivity of the investigated phase change material.

Key observations include:

- Increasing thermal conductivity with graphite content
- Improved heat transfer performance
- Highest values at 10 wt% graphite loading
- Enhanced suitability for thermal energy storage applications

The results demonstrate the effectiveness of graphite nanoparticles for improving heat transport in phase change materials.

Interpretation

The observed thermal conductivity enhancement can be attributed to:

- Formation of conductive graphite networks
- Improved heat transfer pathways
- Reduced thermal resistance within the composite

This results in:

- Faster heat transfer
- Improved charging and discharging behavior
- Enhanced thermal storage efficiency

Industrial Relevance

LFA measurements are widely used for:

- Phase change material development
- Thermal energy storage optimization
- Solar thermal applications
- Electronic thermal management
- Building energy systems
- Advanced energy storage materials

Conclusion

The measurement performed with the Linseis LFA L51 demonstrates the suitability of Laser Flash Analysis for investigating heat transfer properties of phase change materials. The incorporation of graphite nanoparticles significantly improves thermal conductivity and supports the development of high-performance thermal energy storage systems. The optimized composite materials are particularly suitable for thermal management and energy storage applications.

Source:
Moradi, A., Es-haghi, H., Hashemabadi, S.H., Haghgoo, M., Emami, Z.
Thermal Characterization of Eicosane/Graphite Nano-Composite-Based Phase Change Material.
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Adapted from measurements performed using a Linseis LFA L51 (LFA 500) Laser Flash Analyzer.