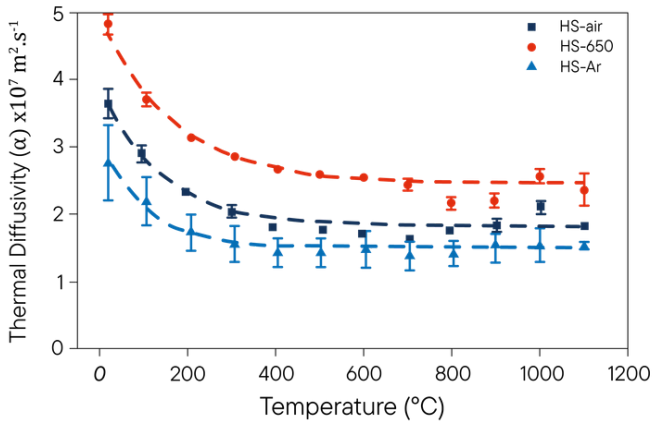
Thermal Diffusivity of Hollow Alumina Thermal Barrier Coatings

Laser Flash Analysis of High-Performance Thermal Insulation Systems

Laser Flash Analysis (LFA) enables the precise determination of thermal diffusivity over a wide temperature range. In this application example, hollow alumina thermal barrier coatings manufactured under different annealing conditions were analyzed to investigate their thermal transport properties and insulation performance for high-temperature applications.

Measurement Setup

- Instrument: Linseis LFA L52 (former designation: LFA 1600)
- Sample: Hollow alumina thermal barrier coatings (HS)
- Temperature range: Room temperature to 1100 °C
- Measurement: Thermal diffusivity
- Application: Thermal barrier coatings for high-temperature systems



The LFA measurement reveals the thermal transport behavior of advanced hollow alumina thermal barrier coatings.
Key observations include:

- Low thermal diffusivity across a wide temperature range
- Decreasing thermal diffusivity with increasing temperature
- Clear influence of annealing conditions on thermal transport
- Excellent insulation potential for demanding high-temperature applications

The results demonstrate the suitability of Laser Flash Analysis for evaluating advanced thermal barrier coating systems.

Interpretation

The observed thermal transport behavior can be attributed to:

- Microstructural changes during annealing
- Hollow alumina sphere morphology
- Coating architecture

This results in:

- Improved understanding of heat transport
- Optimized coating design
- Enhanced thermal insulation performance

Industrial Relevance

LFA measurements are widely used for:

- Thermal barrier coating development
- Aerospace and turbine components
- High-temperature insulation systems
- Energy and power generation
- Materials research and quality assurance
- Advanced ceramic coating optimization

Conclusion

The measurements performed with the Linseis LFA L52 demonstrate the suitability of Laser Flash Analysis for characterizing the thermal diffusivity of advanced hollow alumina thermal barrier coatings. The obtained data provide valuable insights into thermal insulation performance and support the optimization of high-temperature coating systems for demanding industrial applications.

Source:
Boissonnet, G., Grosseau-Poussard, J.-L., Bonnet, G., Pedraza, F.
Development of Thermal Barrier Coating Systems from Al Microparticles—Part II: Characterisation of Mechanical and Thermal Transport Properties.
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Adapted from thermal diffusivity measurements performed using a Linseis LFA L52 (former designation: LFA 1600) Laser Flash Analyzer.