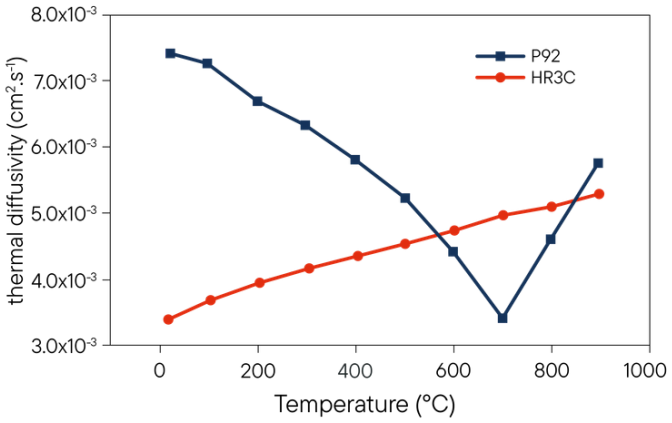
Thermal Diffusivity of High-Temperature Steels

LFA L52 Characterization of Heat Transport in Advanced Power Plant Materials

Thermal diffusivity is a key material property for evaluating heat transfer in high-temperature components such as heat exchangers and steam turbines. Accurate characterization of thermal transport is essential for selecting materials capable of operating under advanced ultra-supercritical conditions. In this study, thermal diffusivity measurements were performed using a LINSEIS LFA L52 to investigate the temperature-dependent heat transport behavior of HR3C and P92 steels. The results provide valuable insight into the thermal performance of advanced power plant materials.

Measurement Setup

- Instrument: LINSEIS LFA L52
- Material: HR3C and P92 Steels
- Temperature Range: Room Temperature to 1000 °C
- Atmosphere: Vacuum
- Measurement: Thermal Diffusivity
- Application: High-Temperature Materials



The laser flash analysis reveals distinct thermal transport behavior for the two investigated steels. Key observations include:

- Continuous increase in thermal diffusivity of HR3C
- Decrease in thermal diffusivity of P92 up to approximately 700 °C
- Rapid increase in P92 above the Curie temperature
- Clear differentiation between austenitic and ferritic-martensitic steels

The results demonstrate the capability of laser flash analysis to characterize temperature-dependent heat transport in high-temperature alloys.

Interpretation

The observed behavior can be attributed to:

- Temperature-dependent heat transport
- Magnetic transition in P92 steel
- Stable thermal behavior of HR3C
- Material-specific microstructure

This results in:

- Reliable thermal characterization
- Optimized material selection
- Improved high-temperature performance

Industrial Relevance

Laser Flash Analysis measurements support:

- Heat exchanger materials
- Steam turbine components
- Power generation systems
- High-temperature alloys
- Thermal transport characterization
- Material qualification for energy applications

Conclusion

The LINSEIS LFA L52 enables precise characterization of thermal diffusivity over a wide temperature range. Understanding the temperature-dependent heat transport behavior of advanced steels is essential for optimizing material selection and improving the efficiency of high-temperature energy systems. These insights support the development of next-generation power plant components.

Source:
Boissonnet, G., Bonnet, G., Pedraza, F.
Thermo-physical Properties of HR3C and P92 Steels at High-temperature.
Journal of Materials and Applications, 2019.
Adapted from thermal diffusivity measurements performed using a LINSEIS LFA L52 (formerly designated as LFA 1600).