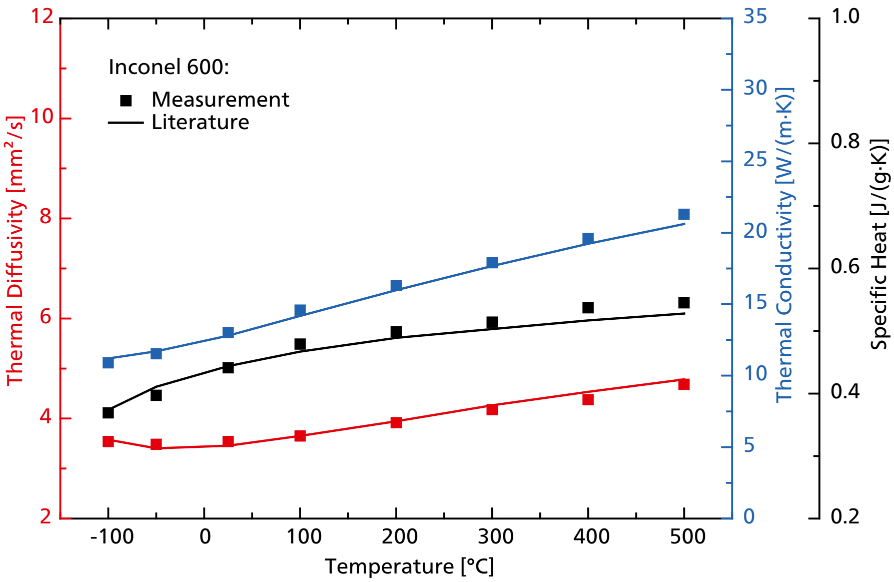
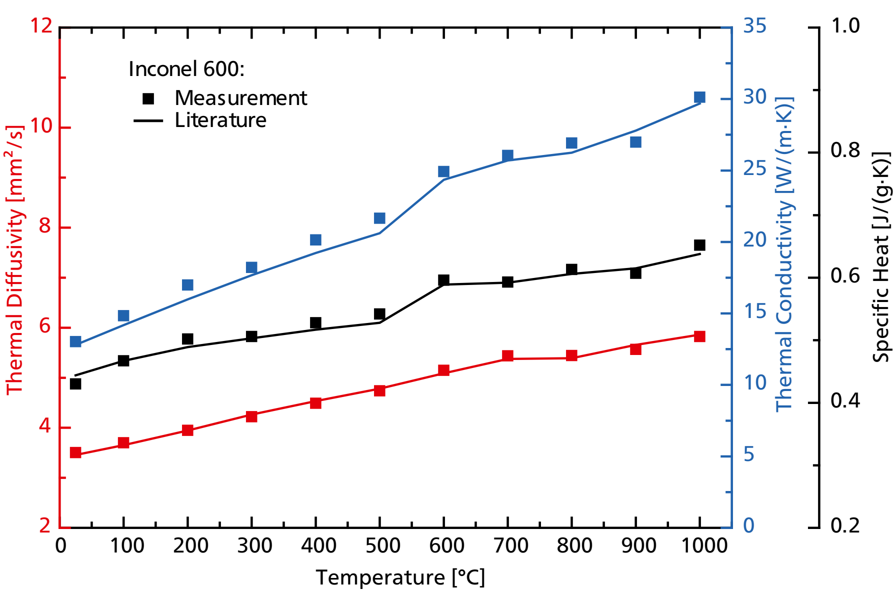
Applications



LFA 467 *HyperFlash*®: A single measurement setup can be used for measuring the thermal diffusivity in the temperature range from -100°C to 500°C. The literature data is represented by the solid lines.



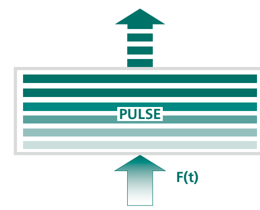
LFA 467 *HT HyperFlash*®: Measurement was carried out between RT and 1000°C for the determination of thermal diffusivity (red), thermal conductivity (blue) and specific heat (black); literature values are represented by the solid lines.

Highest Precision Over the Entire Temperature Range

Both plots on the left portray the determined thermal diffusivity (red symbols), thermal conductivity (blue symbols) and specific heat (black symbols) of Inconel 600 (reference material) over the entire temperature range of the LFA 467 *HyperFlash*® (upper plot) and the LFA 467 *HT HyperFlash*® (lower plot).

For all determined properties, the accuracy levels are below ± 3% at a precision level generally even better than ± 3%.

Thin and Highly Conductive Materials

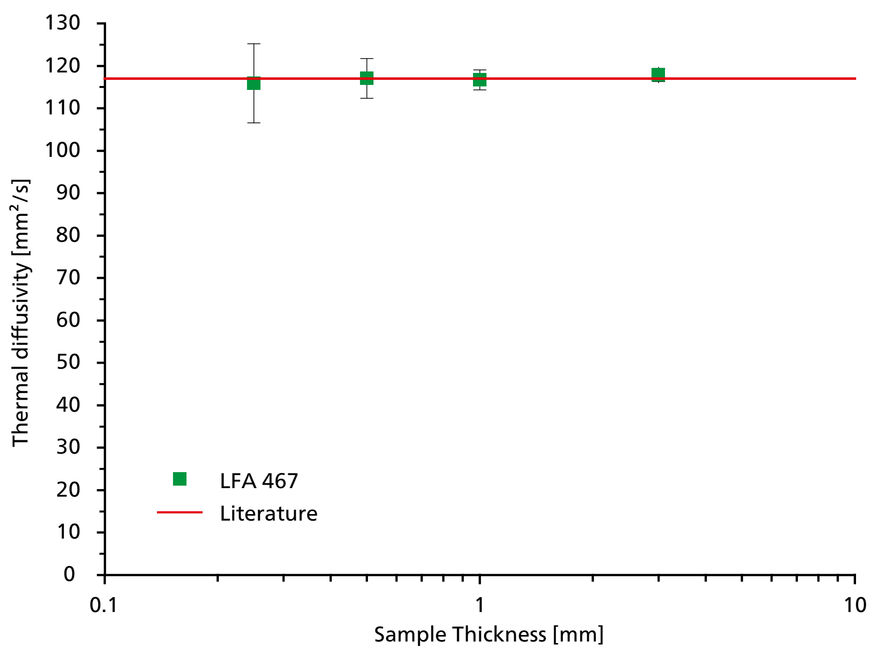


Copper

This plot shows measurements on copper samples with different thicknesses.
This example clearly proves that the system can successfully measure samples with very high diffusivities. In addition, by decreasing the sample thickness from 3.0 mm to 0.25 mm, these measurements confirm that even very thin samples can be tested with very high accuracy.

These measurements are only possible thanks to the 2 MHz data acquisition rate and 20 µs pulse length.

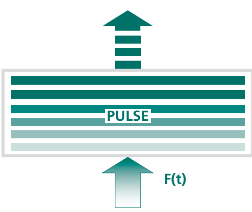
Sample preparation and thickness determination have to be carefully considered when measuring thin samples. This explains the increased uncertainties with decreasing sample thicknesses.



LFA 467 *HyperFlash*®: Thermal diffusivity values for the copper samples are in very good accordance with literature data, irrespective of the sample thickness.

High Data Acquisition and Short Pulse Length

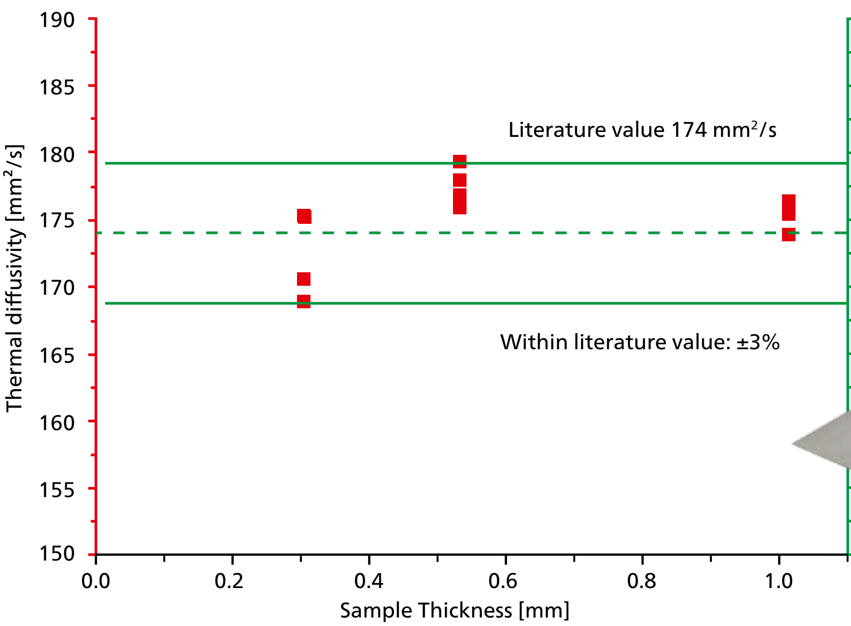
PREREQUISITE FOR THIN FILM MEASUREMENTS



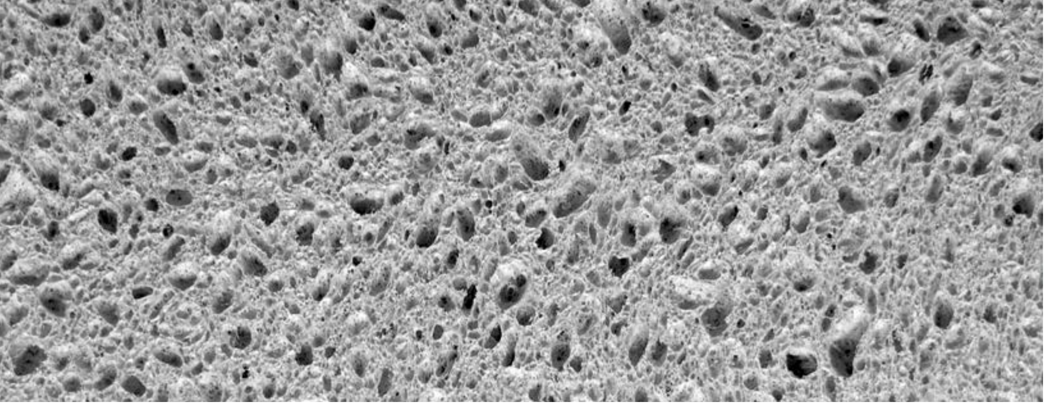
Silver

Silver shows a very high conductivity and is able to reduce the resistance of plated wire. This is particularly beneficial in high-frequency applications because the surface effect will result in increased current flow through the silver.

The thermal diffusivity was determined as a function of the silver plate thickness. The results for the different thicknesses – from low to high – are all within ±3% of the literature value for silver at 300 K.

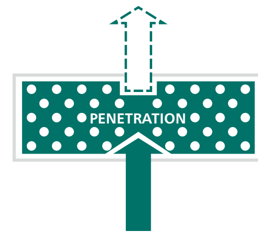


LFA 467 *HyperFlash*®: Thermal diffusivity values of silver specimens of different thicknesses are in very good accordance with literature data.

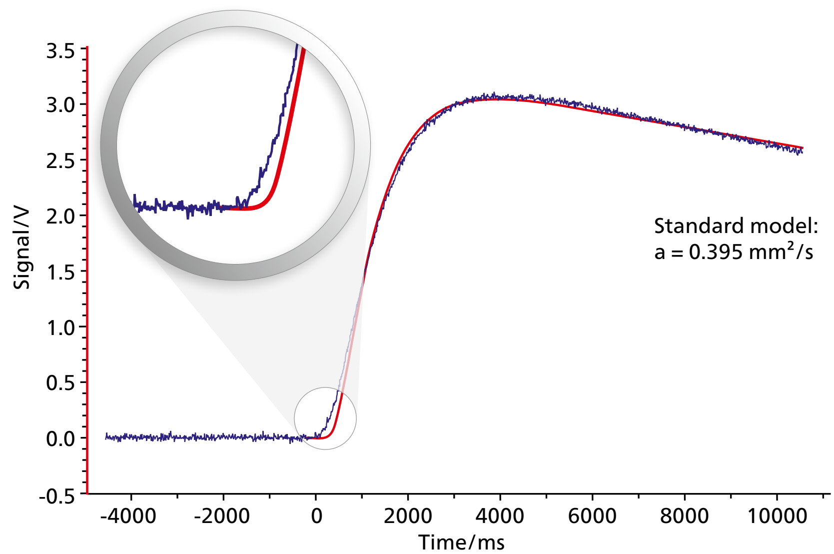


Porous Materials

PENETRATION FOR BEST MODEL FIT

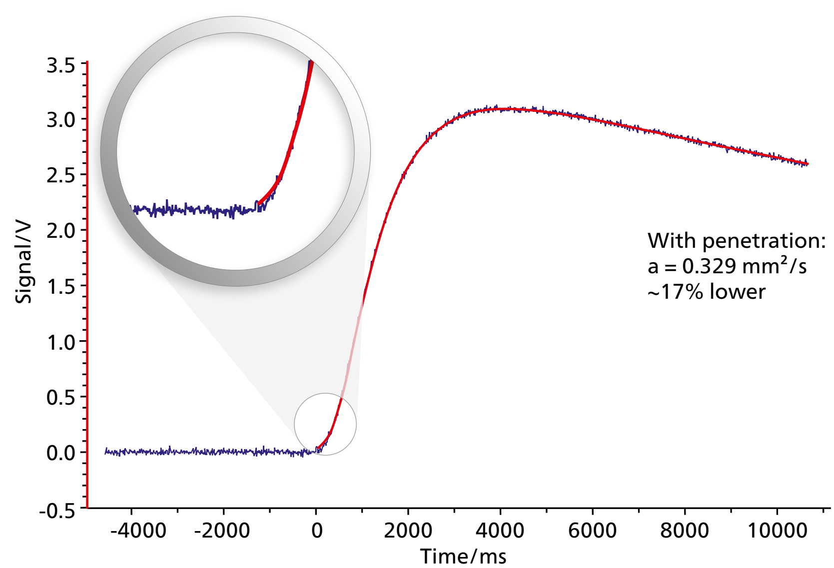


In standard flash method measurements, the pulse energy is totally absorbed on the front face of the specimen. A thermal wave results, traveling through the specimen's thickness before reaching the opposite face. However, in porous materials the absorption of the pulse energy is no longer limited to the front face – it is extended over a thin layer into the specimen thickness. The model for porous materials takes the penetration effect and the resulting decaying temperature distribution into consideration.



Filled Polymer Disc

In the example on the right, the thermal diffusivity of a filled polymer disc with holes was calculated using the standard (upper plot) and contrasted with the penetration model results (lower plot). The thermal diffusivity value yielded by the penetration model was approximately 17% lower than that of the standard model. Correctness of the result can be proven by measuring the same material without holes.



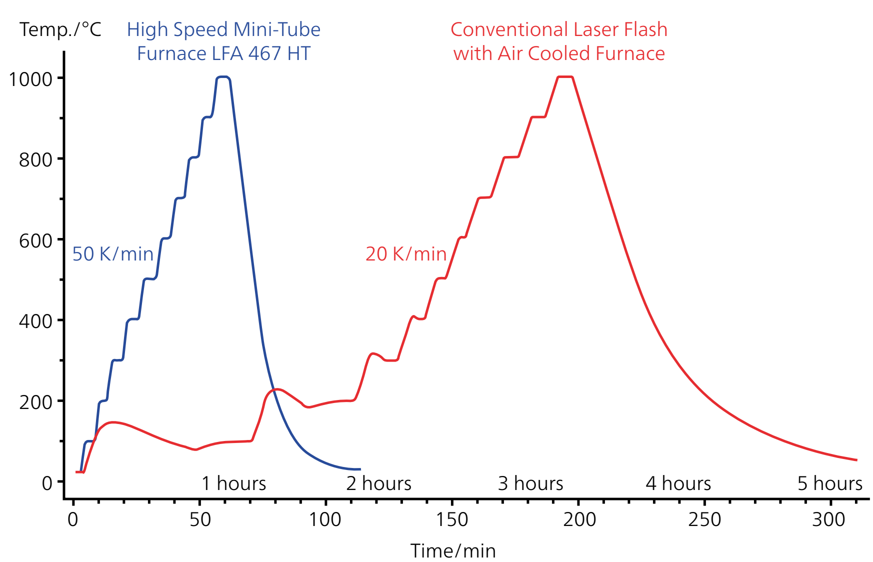
Excellent Stabilizing Behavior at High Temperature

SHORTEST MEASUREMENT TIMES AND HIGH SAMPLE THROUGHPUT

High sample throughput is essential for extensive usage of conventional LFA systems. It can be achieved by using an automatic sample changer, a fast furnace, or a combination of the two.
The LFA 467 *HT HyperFlash®* offers such a combination: Its four individual fast-responding mini-tube furnaces (for four specimens in total) are characterized by low thermal mass and superior stabilizing behavior.

The design offers homogeneous temperature distribution across all samples, which positively affects specific heat (c_p) determination. The combination of these specific features not only guarantees increasing sample throughput but is also a prerequisite for achieving short measurement times.

This figure shows the course of the sample temperature over time for two laser flash systems. A reference sample was measured from room temperature to 1000°C in steps of 100 K. The measurement time for the LFA 467 *HT* was only a third of that compared to the measurement with a conventional laser apparatus with air-cooled furnace.



Course of the sample temperature of an LFA measurement with mini-tube furnace (LFA 467 *HT*) and a furnace with standard air cooling