HAAS

Your knowledge our technology

TRANSIENT HOT BRIDGE

THB Basic
THB Advanced
THB Ultimate

Pobierz naszą wizytówkę:

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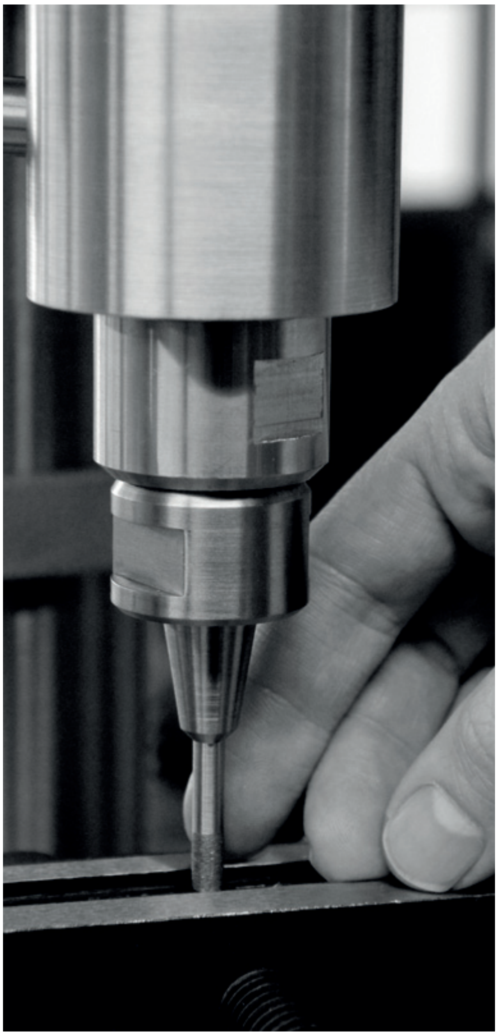
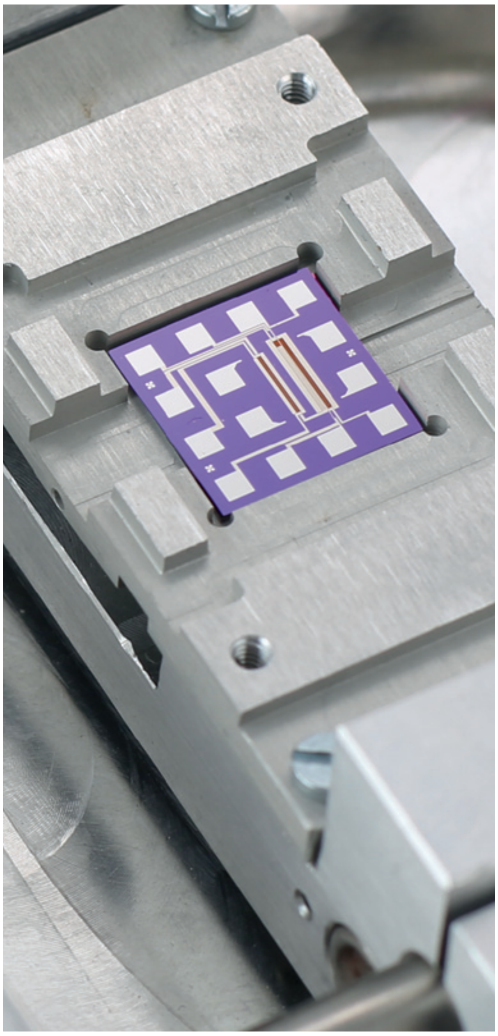




German engineering

The strive for the best due diligence and accountability is part of our DNA. Our history is affected by German engineering and strict quality control.

Innovation

We want to deliver the latest and best technology for our customers. LINSEIS continues to innovate and enhance our existing thermal analyzers. Our goal is constantly develop new technologies to enable continued discovery in science.

THB

TRANSIENT HOT BRIDGE

Knowledge of heat transport properties of materials is becoming more and more crucial. Many application fields like automotive, aviation, aerospace but also power generation / energy industries or ceramics industries, building materials and glass industry and many more need very precise information about the thermal behavior of the used materials.
Heat management is becoming very important in the building industries due to exploding energy costs (isolation) or in the semiconducting industries if we think of power electronics and highly integrated circuits. The ongoing developements require a substantial research & developement process in these two but also many other fields.

Temperature range from -150 to 700 °C

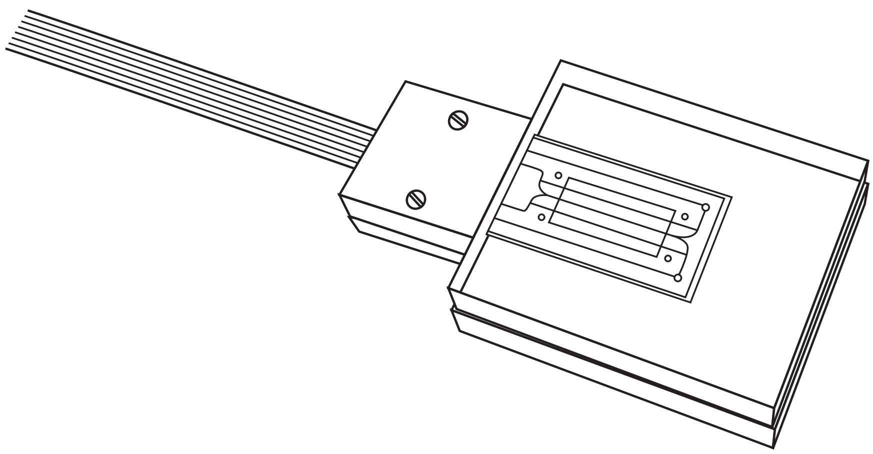
Easy set-up and sample preparation

LINSEIS has a lot of experience in thermal properties measurement and covers a very broad range of different techniques to measure thermal conductivity, thermal diffusivity and specific heat. They include the laser flash method, the hot plate method (heat flux meter) and the hot wire technique.

Method:

The THB measurement method, initially developed by the National Metrology Institute of Germany, is an optimized transient or quasi steady state hot wire to measure all relevant thermal transport properties (thermal conductivity, thermal diffusivity and volumetric specific heat) with the highest possible accuracy.

Broad thermal conductivity range from 0.01 to 1800 W/m•K



Sensor sandwich between two PMMA samples

Improved technology

THB Basic, Advanced and Ultimate Models

Hardware

- Smallest footprint
- Light in weight
- Optimized electronics for highest efficiency
- Fastest data acquisition
- Highest measurement accuracy
- Lowest signal to noise ratio

Software

- User friendly software. Easy to use and powerful in operation
- using EPROMs
- Linseis Intelligence Software for fully automatic operation
  - no user settings required
  - highest accuracy
  - limiting operational errors
- Faster measurements

Compact Design and Innovative Software

The THB - in the model variants "Basic, Advance and Ultimate" - is a smart measuring device series.
Just press a button to initialize the sensor and the measurement parameters are automatically recorded in the software.
In a few seconds, the THB provides automatic measurement results (0.005 up to 1800 W/mK and 0.05 up to 1200 mm^2/s) in the temperature range from -150 °C up to 700 °C.

THB Basic

- suitable for materials with low thermal conductivity (insulation and building materials)
- easy installation – basic installation of the meter is done remotely
- THB/B sensor included (THB/A sensor on request)

THB Advanced

- universal measuring instrument with the widest thermal conductivity range
- suitable for solids, liquids, pastes and powdery materials
- suitable for laboratory service providers, institutes and universities
- easy installation – basic installation of the meter is done remotely
- QSS sensor included (THB/A, THB/B or Hotpoint sensor on request)

THB Ultimate

- high-end instrument for any requirements
- suitable for almost all materials: from insulators to copper, from solids to liquids
- easy installation and training by qualified personnel
- including two sensors of your choice

Specifications

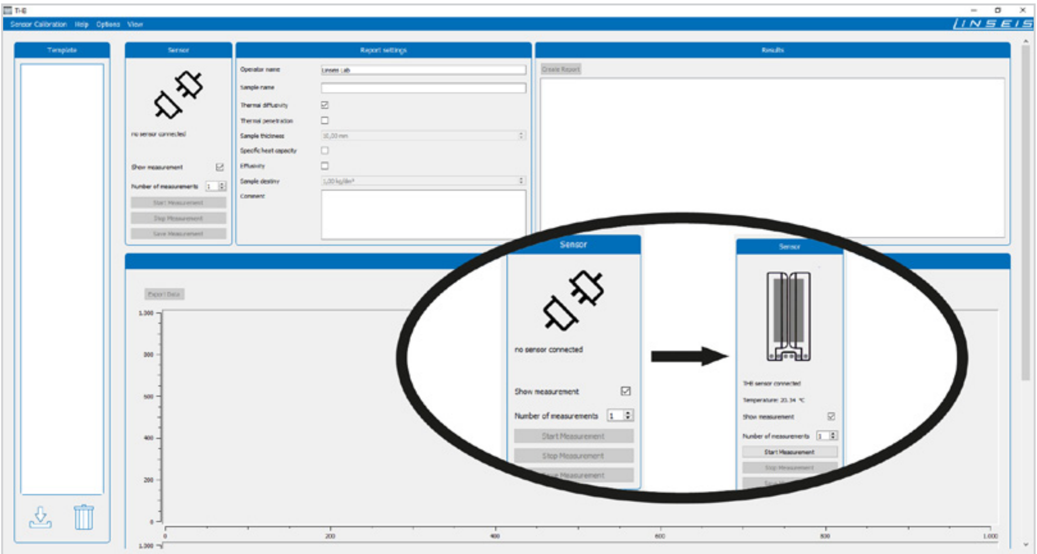
	THB Basic	THB Advanced	THB Ultimate
Measuring range			
Thermal Conductivity	0.01 up to 5 W/mK	0.005 up to 500 W/mK	0.005 up to 1800 W/mK
Thermal Diffusivity	0.05 up to 50 mm^2/s	0.05 up to 300 mm^2/s	0.05 up to 1200 mm^2/s
Specific Heat Capacity	100 up to 5000 $kJ/(m^3K)$	100 up to 5000 $kJ/(m^3K)$	100 up to 5000 $kJ/(m^3K)$
Measuring precision			
Thermal Conductivity**	better than 1 %	better than 1 %	better than 1 %
Thermal Diffusivity**	better than 4 %	better than 4 %	better than 4 %
Thermal Capacity**	better than 4 %	better than 4 %	better than 4 %
Measuring duration			
Solids	approx. 1 up to 10 min	approx. 1 up to 10 min	approx. 1 up to 10 min
Liquids	approx. 1 up to 120 s	approx. 1 up to 120 s	approx. 1 up to 120 s
Operating temperature			
Sensor	-150 up to 700°C	-150 up to 700°C	-150 up to 700°C
Sensor type	Kapton, Ceramics	Kapton, Ceramics	Kapton, Ceramics
Sample size			
Smallest sample size*	1.5 x 1.5 x 2 mm	1.5 x 1.5 x 2 mm	1.5 x 1.5 x 2 mm
Max. sample size	unlimited	unlimited	unlimited

* depends on sensor, material and furnace
** depends on sample sensor and sample preparation

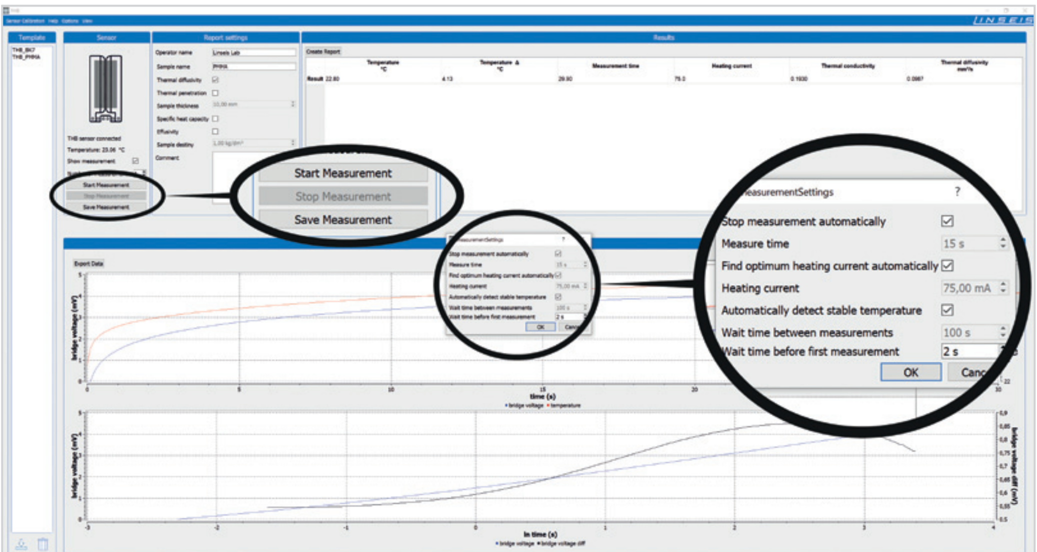
New automatic Software

3 steps to results

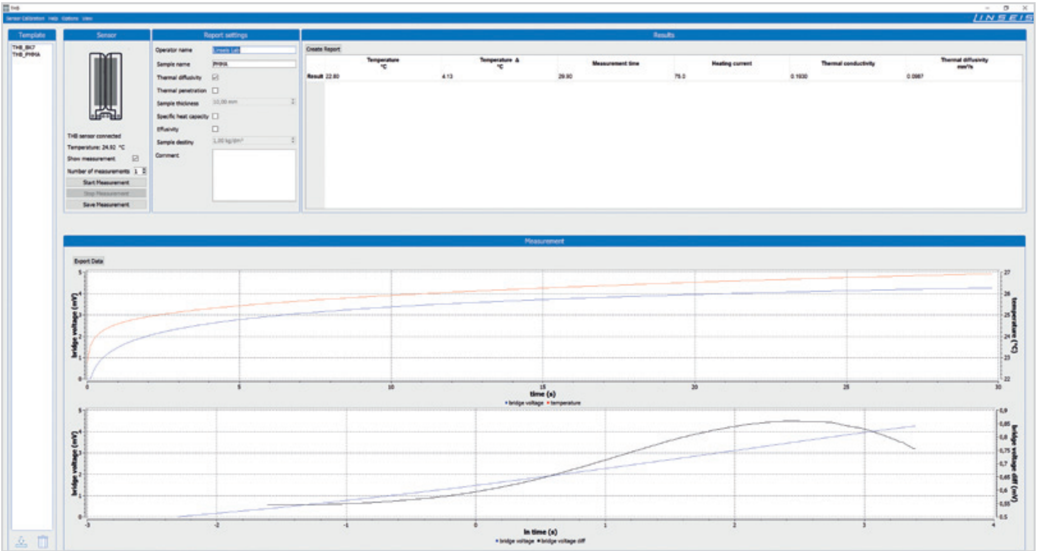
1 Automatic detection of the connected sensor



2 Intuitive user interface for the operation of the instrument and data analysis



3 Linear and logarithmic real time plots and automatic calculation of the results

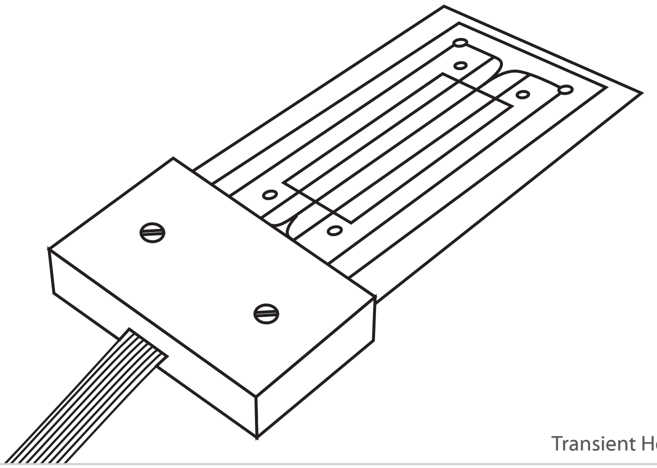


The software allows a quick and easy set up of measurements. The settings like the measurement time and the heating current can be set up manually and automatically. By that the THB can perform automatic measurements with optimized parameters.

The measurement starts with a quick test to find the optimum heating current. After a short stabilization time the measurement starts and the recording of the curves can be tracked in real time. As soon as the measurement is finished the results will be displayed in a table. These results can be stored. It is also possible to export the data into a report (Word, text file, PDF).

Different sensors for various applications and temperatures

Transient Hot Bridge (THB) Sensor



Transient Hot Bridge Sensor

The THB method was developed from the Hot wire and hot strip method.
During the measurement the sensor emits a constant heating current and also heats itself. The temperature rise is recorded using the bridge voltage and is a measure for the thermal properties of the sample.

- patented sensor
- suitable for fast and high accuracy measurements
- Thermal Conductivity, Thermal Diffusivity and Specific Heat Capacity
- uncertainty < 3%
- most accurate sensor for low conductive materials

	Min. sample size*	Temperature range**	Measuring range	Suitable for***
THB/A	20 x 40 x 5 mm	-150 up to 300°C	0.01 up to 20 W/mK	S
THB/A/Metal	20 x 40 x 5 mm	-150 up to 300°C	0.01 up to 5 W/mK	S, P, L
THB/B	10 x 20 x 3 mm	-150 up to 300°C	0.01 up to 2 W/mK	S
THB/B/Metal	10 x 20 x 3 mm	-150 up to 300°C	0.01 up to 2 W/mK	S, P, L
THB/A/HT	20 x 40 x 5 mm	RT up to 700°C	0.01 up to 1 W/mK	S

* The exact min. sample size depends on the material properties.
** The maximum temperature for a performance under air is +200 °C. The temperature range can be exceeded up to +300 °C in inert gas atmosphere.
***Solid (S), Powder (P), Liquid (L)

Hot Point Sensor

Bild fehlt mir!

Hot Point Sensor

The Hot Point Sensors are suitable for very small volume specimens down to 2x2x1 mm.

Due to its very low thermal mass, the sensor responds to sudden temperature changes in some milliseconds. The sensor simultaneously acts as a thermometer and a heat source and therefore is ideal as a thermal transport properties sensor.

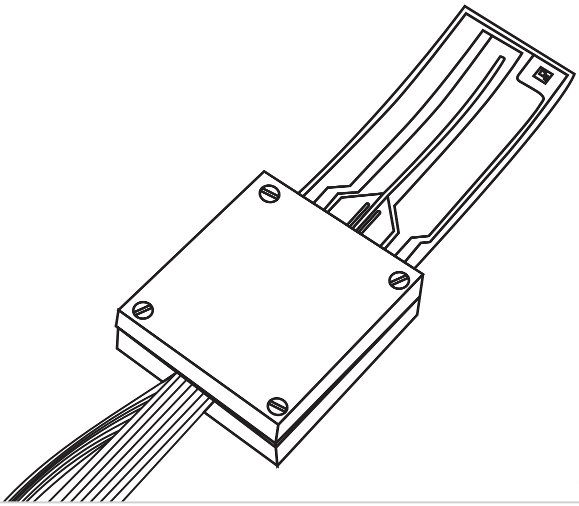
The thermal conductivity of the samples can becalculated from the temperature increase vs. time with established heat flow equations.

- Suited for measuring small or anisotropic samples
- Uncertainty about 5 % –10 %
- Sensor is heated by a heating current
- Temperature rise as function of time is measured

	Min. sample size*	Temperature range**	Measuring range	Suitable for***
Hotpoint	1.5 x 1.5 x 2 mm	-150 up to 200°C	0.01 up to 30 W/mK	S, P, L
Hotpoint HT	10 x 10 x 10 mm	RT up to 700°C	0.01 up to 5 W/mK	S
Hotpoint HT/L	1 ml	RT up to 700°C	0.01 up to 5 W/mK	L, P

* The exact min. sample size depends on the material properties.
** The maximum temperature for a performance under air is +200 °C. The temperature range can be exceeded up to +300 °C in inert gas atmosphere.
***Solid (S), Powder (P), Liquid (L)

Quasi Steady State (QSS) Sensor



Quasi Steady State Sensor

For highly conductive materials the heat transport can be so fast that it cannot be detected with transient hot wire methods. The solution for such samples is the QSS sensor, a quasi-steady state technique which eliminates the time constant of instruments. It combines characteristic advantages of steady-state and transient techniques.

The QSS sensors contain a heater and two temperature sensors. The temperature difference between the two sensors is measured. After a short setting time during which all transients die out, the instrument operates under quasi-steady state conditions.

No guard heaters are required because outer boundaries are free to change with time.

- suited for samples with a high thermal conductivity
- Uncertainty < 5%
- Bridge circuit integrated in the sensor
- very broad measurmement range

	Min. sample size*	Temperature range**	Measuring range	Suitable for***
QSS	25 x 55 x 3 mm	-150 up to 300°C	0.005 up to 1800 W/mK	S
QSS HC	25 x 55 x 3 mm	RT up to 700°C	0.2 up to 100 W/mK	S

* The exact min. sample size depends on the material properties.

** The maximum temperature for a performance under air is +200 °C. The temperature range can be exceeded up to +300 °C in inert gas atmosphere.

***Solid (S), Powder (P), Liquid (L)

Specifications

	THB Basic	THB Advanced	THB Ultimate
Thermal Conductivity range	0.01 to 5 W/mK	0.005 to 500 W/mK	0.005 to 1800 W/mK
Thermal Diffusivity range	0.05 up to 50 mm^2/s	0.05 up to 300 mm^2/s	0.05 up to 1200 mm^2/s
Specific Heat Range	100 to 5000 $kJ/(m^3K)$	100 to 5000 $kJ/(m^3K)$	100 to 5000 $kJ/(m^3K)$
THB-Sensors	✓	✓	✓
QSS-Sensors	✗	✓	✓
Hotpoint-Sensors	✗	✓	✓

Measured parameters	Thermal Conductivity, Thermal Diffusivity, Specific Heat, Effusivity
Measuring method	Transient Hot Bridge and Quasi Steady State Method
Temperature range	From -150°C up to 700°C
Sample size	Smallest sample size: 1.5 x 1.5 mm Largest sample size: unlimited
Sensor Types	Kapton, Ceramic
Reproducability	Better than 1%
Accuracy	Better than 3% for most samples
Instrument dimensions	200 mm x 200 mm x 65 mm
Power requirements	36 Watt, 65 to 264 V (AC), 47 to 63 Hz (US/EU socket included)
Software	Advanced THB Windows® based software interface. Allows fastest measurement times on the market. No room for user errors thanks to optimized, software-controlled measurement algorithms. This allows for most accurate and time saving measurements available. One button solution. Easy data export to Microsoft Excel®

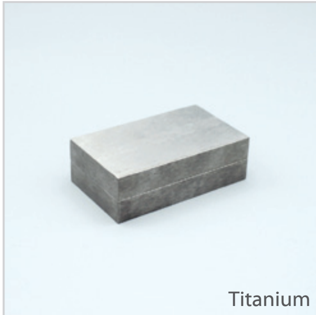
Complies to the following Norms:

- ASTM D 5930-01
- ISO 22007-2
- ASTM D 5334

Accessories


Copper

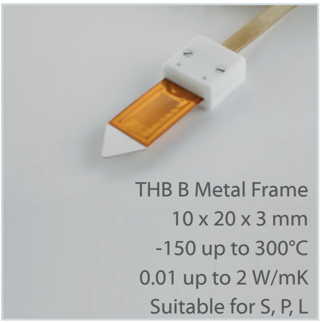

BK7


Titanium


PMMA


Zinc


THB A
20 x 40 x 5 mm
-150 up to 300°C
0.01 up to 20 W/mK
Suitable for S


THB B Metal Frame
10 x 20 x 3 mm
-150 up to 300°C
0.01 up to 2 W/mK
Suitable for S, P, L

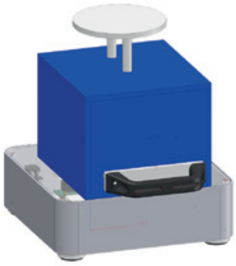

THB B
10 x 20 x 3 mm
-150 up to 300°C
0.01 up to 2 W/mK
Suitable for S

Hot Point
1.5 x 1.5 x 2 mm
-150 up to 200°C
0.01 up to 30 W/mK
Suitable for S, P, L, G


Ceramic

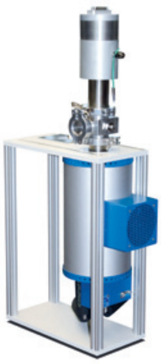

QSS
25 x 55 x 3 mm
-150 up to 200°C
0.005 up to 1800 W/mK
Suitable for S

Press for defined pressure



Standard THB furnace – Peltier cooling

Basic press with manual stage



Furnace for phase change materials (PCM)

Furnaces and climatic chambers

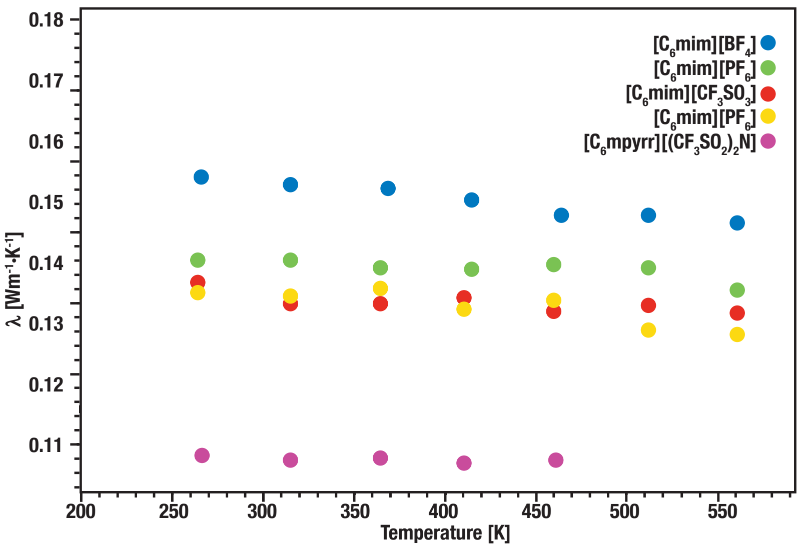
- Standard THB furnace – Peltier cooling (-20 up to 50°C)
- Standard THB furnace HT – with heating cartridges (RT up to 200°C)
- High temperature furnace (RT up to 1000°C)
- Low temperature furnace for large samples max. 60 x 100 x 30 mm (-125 up to 500°C)
- Furnace for controlled humidity (-20 up to 80°C)
- Furnace for liquids, powders and pastes (150 up to 500 °C)

Further accessories

- Press for defined pressure on the specimen (test stand, handwheel operated up to 500 N, digital force gauge up to 250)
- Specimen holder for liquids
- Specimen holder for powder
- Transport case for the THB
- Various calibration materials (PMMA, glass, titanium, tin, zinc)

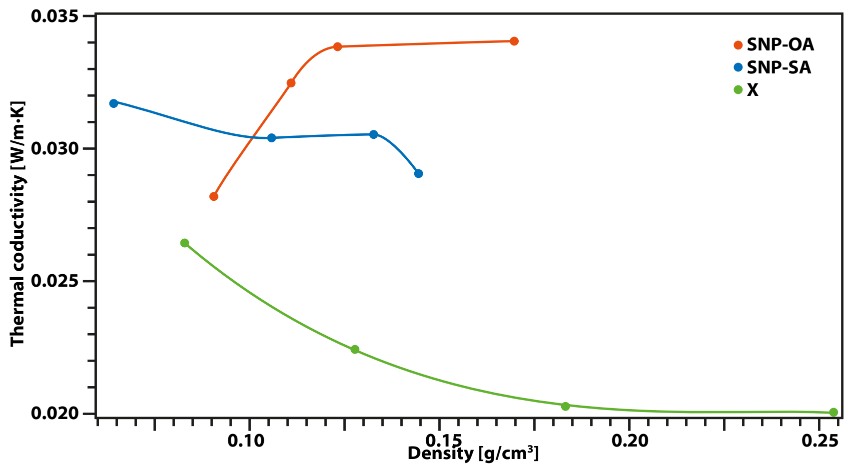
Applications

Thermal Conductivity of Ionic Liquids



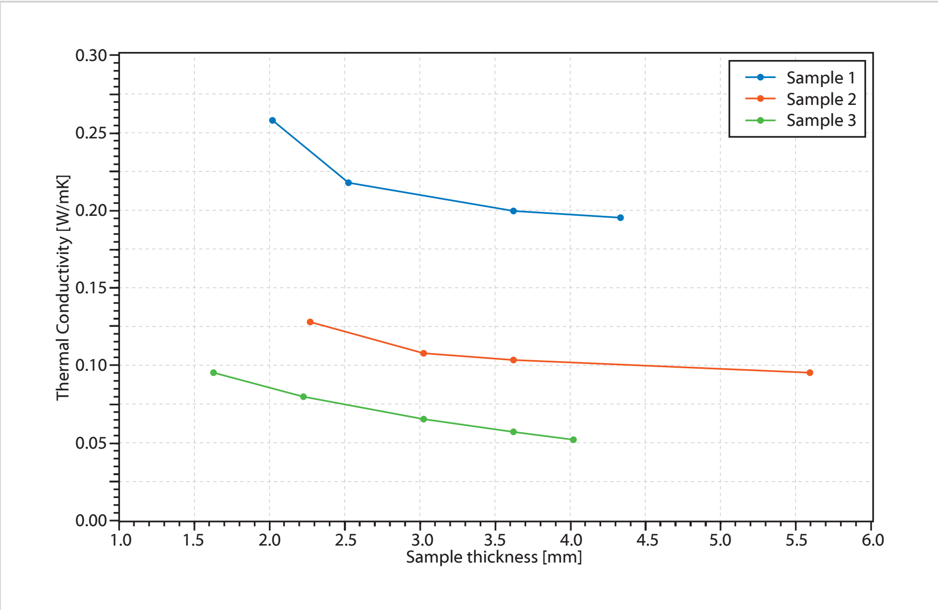
The LINSEIS Transient Hot Bridge Analyzer (THB) is the most accurate method on the market to measure the thermal conductivity of Ionic Liquids form -150 to 700 °C.
With this optimized Hot Wire technique, measurements can be performed in the liquid as well in the solid state at low temperatures. The measurement time is below one minute.
The figure shows the thermal conductivity of various Ionic Liquids as a function of the temperature.

Aerogel powders



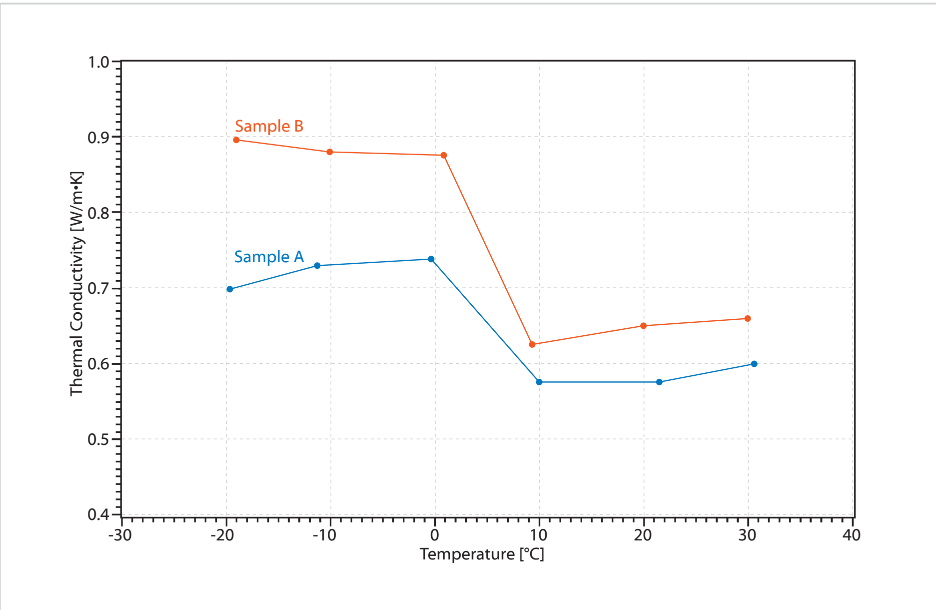
Thermal conductivity of Aerogel powders at different densities. The measurements have been performed with a powder sample holder with which the volume and therefore the density can be varied.

Insulation material – Thermal conductivity (THB Advanced)



The thermal conductivity of three different insulation materials was investigated in dependence on the thickness of the material, thus, the compression of the material. The insulation material consisted of a glass wool in between a fabric. The measurement was performed with a THB Advance. The given thicknesses, starting with the highest one, were set and at each thickness the thermal conductivity was determined four times in a row. The average of those is plotted in the graph. Here, one can see that for each material the thermal conductivity increases when the pressure onto the sample increases, i.e. the thickness decreases.

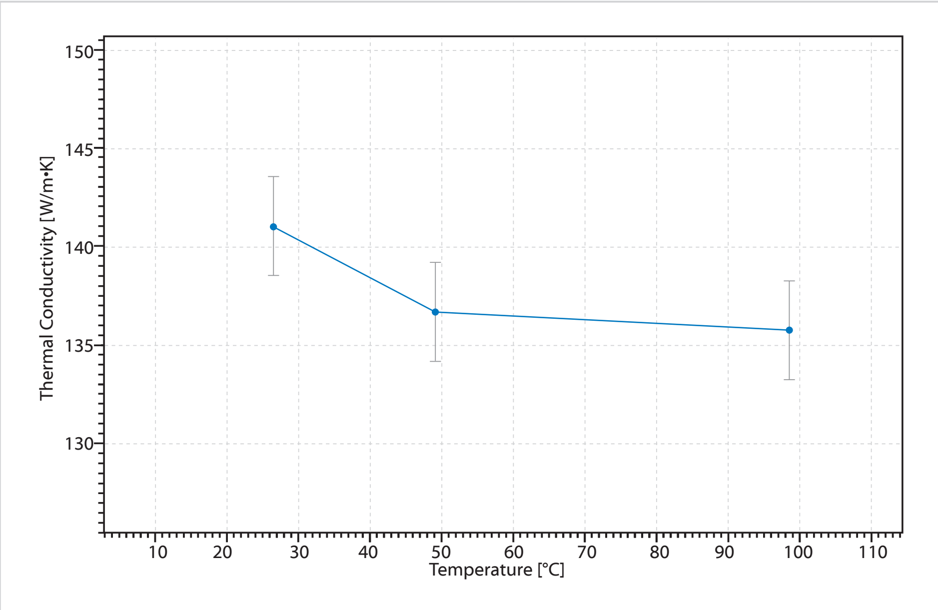
Phase Change Material –Thermal Conductivity (THB Basic/Advanced)



The example shows the analysis of the thermal conductivity of two hydrated salts. At room temperature both samples were liquid. For the measurement the sensorTHB/B/Metal was hung into the sample. Three measurement points were recorded at each temperature level and averaged.

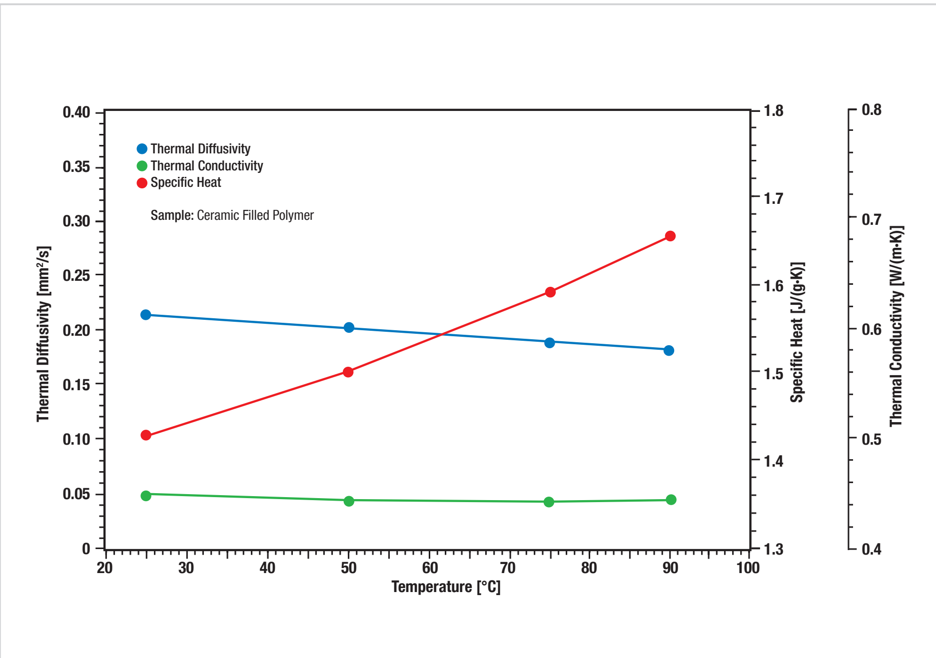
The thermal conductivity of Sample A slightly increases with heating up to 0 °C, whereas Sample B shows slightly decreasing values. Both samples change from the solid to the liquid state in the temperature range from 0 °C to 10 °C which can also be clearly seen in the thermal conductivity drop. With increasing temperature, the thermal conductivity of both samples increases slightly.

Aluminium Alloy – Thermalconductivity (THB Advanced)



The thermal conductivity of an aluminiumalloy was investigated from room temperatureto 100 °C using the THB. For the measurementthe QSS sensor was placed between twosample pieces and pressed together for animproved thermal contact. The configurationwas placed in a furnace and the temperaturesteps were room temperature, 50 °C and 100°C. At each step the measurement wasrepeated three times and the results wereaveraged. In the diagram one can see that thethermal conductivity is slightly decreasingwith temperature. The error bars show anuncertainty of 2 %.

Ceramic filled polymer



To optimize material properties a big variety of additives are known and used in material technologies and composite materials are of big interest, too. Even more important is the exact examination of the real properties of these materials, which can vary widely due to production conditions and mixture. Composite materials are widely used from electronic to building materials industries.

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