Hukseflux
Thermal Sensors

STPSYS05

Surface thermal properties measuring system

STPSYS05 is a non-invasive, easy-to-use and affordable system for measuring the thermal conductivity at the surface of a specimen. Applications include:

- *measurement of thermal conductivity combined with an estimate of thermal diffusivity, for material characterisation purposes*
- *comparative thermal property measurements for quality control purposes, relative to a "known" reference specimen*

The system can be connected to a local area network (LAN) or USB port and offers an intuitive and simple to use graphical user interface that you can access via your web browser. STPSYS05 is available as a complete measuring system, the STP05 sensor is also offered as a separate 'sensor only' product.

Figure 1 *STP05 thermal properties sensor, with a schematic view of the cylindric thermal field (isotherms). STP05 is conveniently placed at the surface of the specimen, and the heat from STP05's line-source penetrates several millimetres into the material; the measurement is representative for this entire volume.*

Figure 2 *STP05 sensor being applied on a smooth, flat surface*

Introduction

STPSYS05 is a practical system for measuring the thermal conductivity at the surface of materials. The measurement method has many advantages, and requirements for specimen preparation and dimensions are limited. Performing a measurement is easy and fast: simply place the sensor on a smooth flat surface of your material and you can measure its thermal conductivity. STPSYS05 is suitable for materials in the 0.1 to 15 W/(m·K) range (see the manual for rated measurement ranges and expected uncertainties). Materials include plastics, stone, rock, composites, soils, pastes and foodstuff.

The STPSYS05 system consists mainly of a Measurement and Control Unit (MCU) and the STP05 sensor. STP05 combines a heater (line source) with two temperature difference sensors (thermopiles) placed on either side of the heater. When STP05 is placed on a specimen and power is applied to the heater, this creates a temperature difference which is measured by the thermopiles. The measurement is steady-state; interpretation is easy. The thermal conductivity is calculated by the software of the MCU from the heater power and the measured temperature differences. In addition to the thermal conductivity, information about the thermal diffusivity and volumic heat capacity can be obtained from the time response of the thermopile signals.

STPSYS05 advantages

- affordable
- non-invasive: all that is required is a smooth flat surface over the sensor area and sufficient specimen thickness below that surface. There is no need for specific specimen dimensions.

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- single-sided testing: only one specimen is required.
- fast to work with: smart sensor design reduces sensitivity to thermal shocks and gradients. The time needed to stabilize before a measurement is short, in the order of 5 minutes.
- easy-to-analyse steady-state measurement of thermal conductivity.
- intuitive and easy to use graphical user interface, accessible using your web browser. No software installation required on your PC.

Suggested use

- specimen testing in material science labs
- quality control and verification of consistency of materials
- educational purposes; use in student labs

Figure 3 *the complete STPSYS05 system. The STP05 sensor, also available as a 'sensor only', is meant for measuring the thermal conductivity of materials at their interface. It is equipped with a heater (line source), a temperature difference sensor (thermopile) and a temperature sensor (thermistor).*

STPSYS05 specifications

Measurand	thermal conductivity
Rated measurement range	0.1 to 15 W/(m·K)
Optional measurand	thermal diffusivity estimate
Rated measurement range	(0.05 to 1.0) x 10^{-6} m^2/s (see manual)
Included cable	1 x cable with 2 connectors (1.5 m)
Typical measuring time	5 minutes

STP05 specifications

Weight	0.34 kg
IP protection class	IP67
Connector	male 8 pin circular M12-A
Rated operating temperature range	-20 °C to +80 °C
Heater	line source
Length	0.06 m
Nominal electrical resistance	15 Ω
Temperature difference sensor	thermopile
Nominal sensitivity	0.2 mV/K
Thermal resistances	
Nominal parallel	1.90 m·K/W
Nominal serial	0.022 m·K/W
Temperature sensor	thermistor
Resistance at 25 °C	10 kΩ ± 1 %
β [25 °C/85 °C] factor	3570 K ± 3 %

MCU specifications

Graphical user interface	web page (via MCU)
Connection	local area network (LAN) or "Ethernet over USB"
IP protection class	IP54
Rated power supply voltage	10 to 16 VDC
Adapter power supply	100 – 240 VAC 50/60 Hz
Rated operating temperature range	- 25 to +50 °C
Sampling rate	10 Hz

How to employ STPSYS05

STPSYS05 can be used to measure thermal conductivities in the range from 0.1 to 15 W/(m·K). In addition to the thermal conductivity, STPSYS05 gives an estimate of the thermal diffusivity.

STP05 sensor is placed on a smooth surface of the material of which the thermal conductivity is to be measured. For higher accuracy results, glycerol may be used as a thermal contact fluid to ensure minimal interfacial thermal resistance between the sensor and the material. The measurement can be monitored and controlled via the MCU.

Calibration & performance assessment

STP05 is supplied with a calibration certificate stating the sensitivity and the thermal resistances of the sensor. For quality assurance purposes, STPSYS05 system includes a calibration reference specimen.

Rated operating conditions

STPSYS05 can be used in laboratory as well as industrial environments. STP05 sensor can be used to perform measurements at temperatures from -20 °C to +80 °C and STP05 is protected against ingress of water, rated IP67.

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User interface: MCU is a web server

The MCU performs measurements, data storage and calculation of the measurement result. It acts as a web server that can be connected to any local area network. A user interface is available as a web page.

Alternatively, the MCU can be connected to a PC via USB. In that case the web page is available via "Ethernet over USB" or a virtual Ethernet link. If you type the MCU's IP address (192.168.66.1 by default) into your web browser, you have access to the user interface.

Parameters such as the heater power setting, total measurement time and specimen description can be entered through the user interface. A thermal conductivity measurement is then started by a simple click of a button. During the measurement, the user interface displays live information such as the measurement progress, remaining measurement time, heater power, temperature difference and absolute temperature. At the end of the measurement, the system automatically calculates and displays the measured thermal conductivity. The system also determines a characteristic time and if possible a thermal diffusivity estimate.

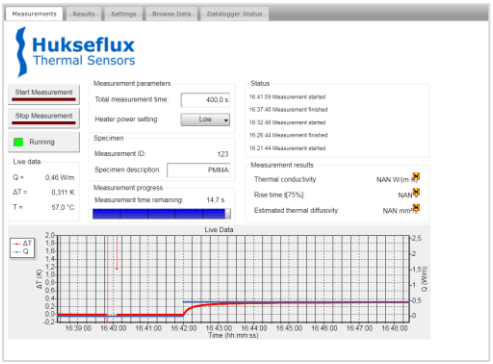

Figure 4 *STPSYS05's user interface: the main screen is used to start measurements, display live data and results*

Options

- STP05 surface thermal properties sensor only
- Keyboard/Display for operating the system without a PC

See also

- THASYS Thin heater apparatus for thermal conductivity measurement
- THISYS Apparatus for thermal conductivity measurement of thin samples
- TP02 and TP08 needle based thermal properties sensors. TPSYS02 turn key measuring system for needle-based sensors
- TP01 thermal properties sensor

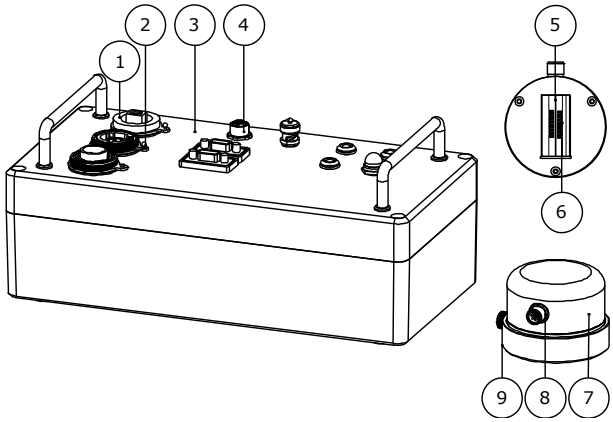

Figure 5 *overview of the STPSYS05 system: (1) USB port, (2) ethernet port, (3) MCU Measurement and Control Unit, (4) connector for STP05 sensor, (5) bottom view of STP05 sensor with heater (line source), (6) STP05's thermopiles, (7) body of STP05 sensor, (8) STP05's connector, (9) protective cap*

Ordering STPSYS05

STPSYS05 comes with the following:

- STP05 sensor with protective cap and calibration certificate,
- a 1.5 m M12-A cable to connect the sensor to the MCU,
- a calibration reference specimen for calibration purposes,
- a measurement and control unit (MCU),
- a power supply.

Ordering STP05 sensor only

STP05 is also available as a "sensor only". In this configuration the user must provide a stable switchable power supply to power the heater, an Ohm meter to measure the thermistor electrical resistance and a high-resolution voltmeter to measure the thermopile output voltage and voltage across the heater. When ordering an STP05 only, the user is responsible for data analysis.

About Hukseflux

Hukseflux Thermal Sensors offers measurement solutions for the most challenging applications. Our main area of expertise is measurement of heat transfer and thermal quantities such as solar radiation, heat flux and thermal conductivity. Hukseflux is ISO 9001 certified. Hukseflux sensors, systems and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

Interested in this product?
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