FP2C v1.13

Device for measuring: Thermal conductivity, thermal effusivity and thermal diffusivity

Hot Wire Conductivimeter

The Hot Wire is the classic transitory method for thermal conductivity measurement of insulating materials.

The system is composed of a
- thermal shock sensor
- an electronic acquisition system
- a software for testing guidance and data processing

Principle

The shock sensor principle is to locally induce a soft heating to the material (few degrees above ambient temperature) and to measure this temperature rise in time (few minutes).

A mathematical processing of this signal (which is integrated in the software) calculates the thermal conductivity.

This sensor and device principle has been developed by the CSTB (Technical and Scientific Center for Building). It also derives from the ASTM D5930-97 and AAC 11-3 RILEM Recommendation.

Our system includes

- Signal's conditioning and Hot Wire management box
- Hot Wire sensor (50 mm)
- Hot Wire management and associated thermal conductivity calculation's software *

- PC (optional)

- Hot Surface sensor (optional)
- Thermal effusivity calculation sofware * (optional)
- Hot Ring sensor (optional)
- Thermal diffusivity calculation sofware * (optional)

** Software's licence without source code, software's modifications or reproduction are forbidden.*

Hot Surface and Hot Ring options

This device can be complemented with a Hot Surface sensor (estimated thermal effusivity) and/or a Hot Ring sensor (estimated thermal diffusivity) and their associated software.

Hot Wire Conductivimeter
(not contractual picture)

Technical characteristics

- **samples**
  solids, pastes, powders, fibbers …
- **minimal size of the sample**
  60 x 45 mm, from a few millimetres thickness for insulating material to few centimeters for conductors
- **conductivity scale**
  0,02 à 5 $W.m^{-1}.K^{-1}$
- **measurement precision** : 5%
- **reproductibility** : 3%
- **temperature scale**
  from -60 to 100°C
- **electric supply** : 220V-230V, 50Hz

NeoTIM

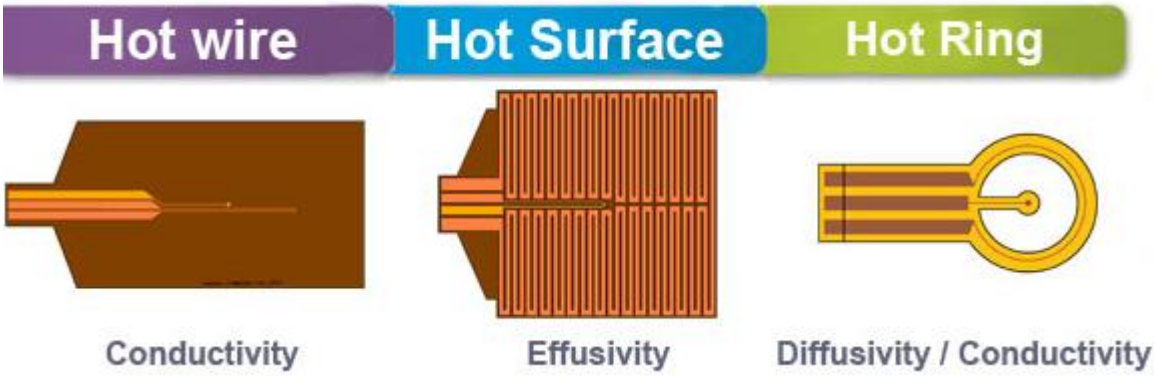
54 rue Gustave Eiffel 81000 ALBI France
Tél. +33 (0)5 63 48 14 38 - Fax +33 (0)5 63 48 14 30

SARL NEOTIM – RCS Albi 484 551 866

contact@neotim.fr
http://www.neotim.fr

Measurement methods used in the FP2C

Measurement methods : For each measure one sensor



Most thermophysical characterization methods we have developped use principle of thermal shock probes. A thermal excitation is realised on the surface of the material, the response to this excitation depends of the thermal properties.

Advantages of these methods are the fast action and some flexibility regarding the size of the samples.

Simply plug in the appropriate sensor on the FP2C device and use the associated software.

Hot Wire Method

The hot wire method is used to estimate the thermal conductivity of a material from the evolution of temperature measured by a thermocouple placed near a resistive wire.

Conductivity from 0,02 to 5 $W.m^{-1}.K^{-1}$
Temperature scale from –60 to 100°C
Samples*: 60 x 45 mm, from a few millimetres thickness for isolating material to a few centimeters for conductors.*

Hot Surface

The FP2C can be complemented with a hot surface sensor to determine the thermal effusivity of material.

Effusivity scale: from 20 to 10000 $J.m^{-2}.K^{-1}.s^{-1/2}$
Temperature scale: from -60 to 100°C
Minimal size of sample: 50 x 50 mm, from a few millimetres thickness for insulating material to a few centimeters for conductors.

Hot Ring Method

The FP2C can be also complemented with a hot ring sensor to determine the thermal conductivity and estimate the thermal diffusivity of material.

Conductivity from 0,5 to 15 $W.m^{-1}.K^{-1}$
Température scale from –60 to 100°C
Samples: minimal size 25 x 25 mm, from few millimetres thickness for insulating material to few centimeters for conductors.

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