Thermal Conductivity of Liquids
Transient Hot-Wire Technique

thw-01L The first portable instrument with 1% absolute uncertainty

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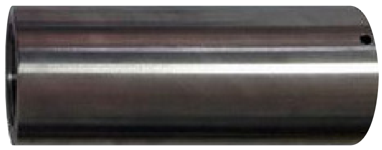
To avoid end effects, two wires identical except for their length, are employed. Thus, if arrangements are made to measure the difference of the resistance of the two wires as a function of time, the measurement corresponds to the resistance change of a finite section of an infinite wire (as the end effects being very similar, are subtracted), from which the temperature rise can be determined. This way absolute measurements can be performed (i.e. no calibration or reference sample is required)



According to Fourier's Law for heat conduction, the thermal conductivity is the property of a fluid to conduct heat.
The fluid must be homogeneous.

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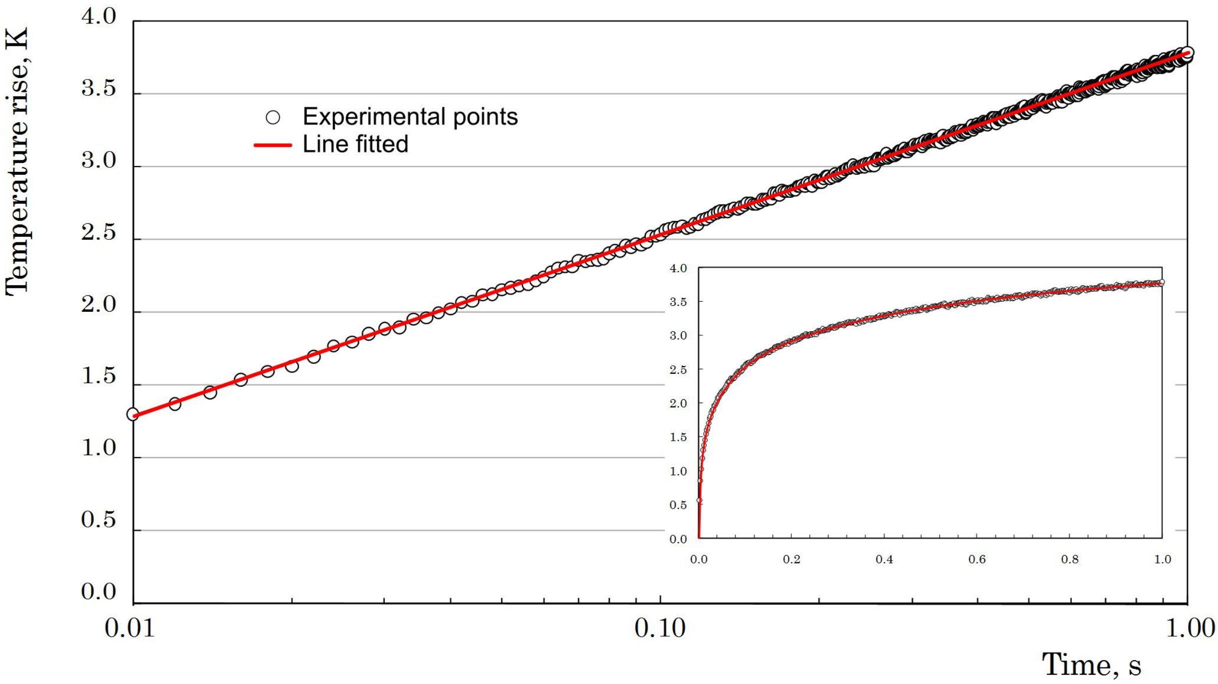
An automatic electronic bridge records 500 resistance rise points in time from 0.01 to 1 s. These are converted to temperature rise vs time. Once small correction have been applied (because of the heat capacity of the wire, the variable fluid properties, and the outer boundary of the cell), the thermal conductivity is obtained from the slope of the temperature rise ve time.



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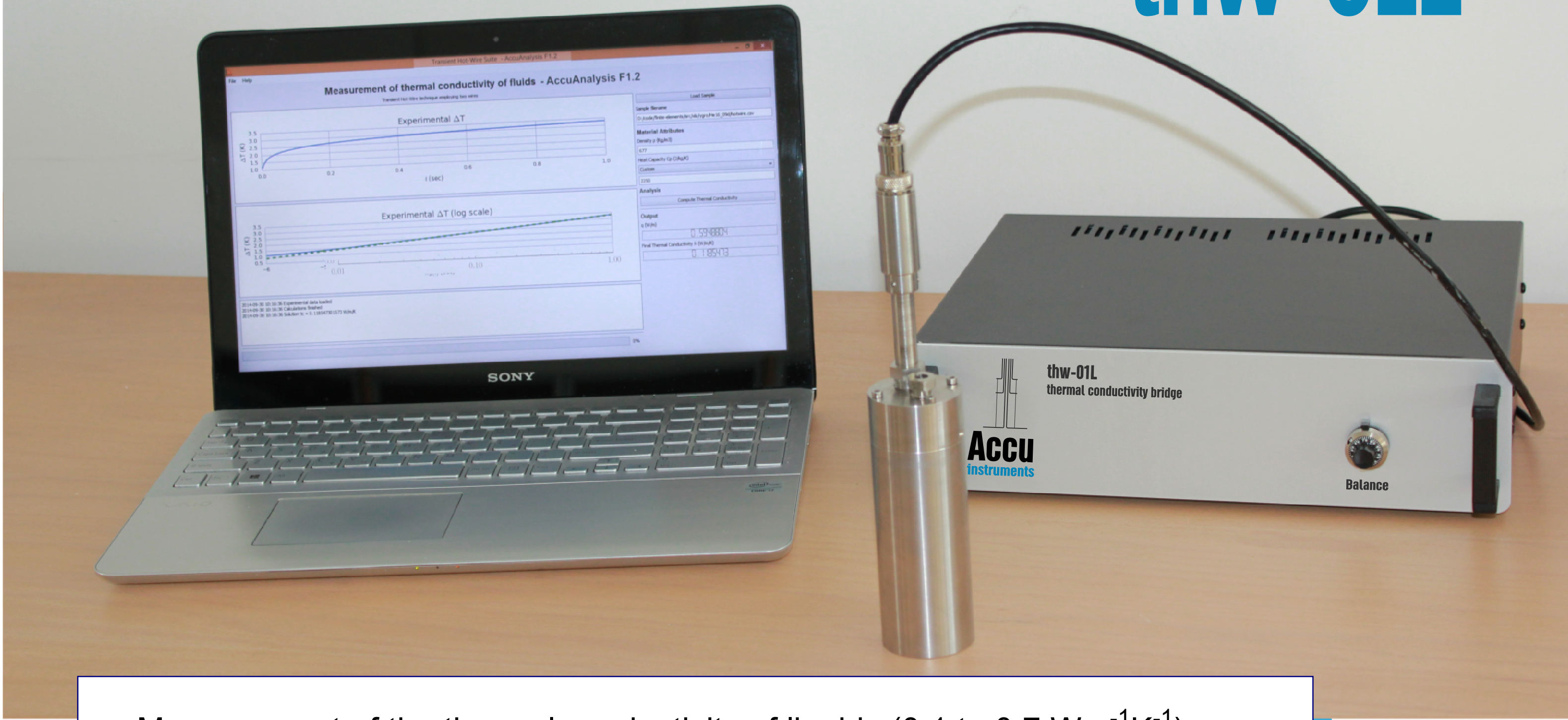

- Measurement of the thermal conductivity of liquids (0.1 to 0.7 $Wm^{-1}K^{-1}$)
- Transient Hot-Wire technique (2-Ta wires)
- Reliable results with low absolute uncertainty of 1%
- Portable easy to use instrument
- Full theoretical model. No approximations!
- Absolute technique, i.e. no calibration or reference sample is required.
- Suitable for users in industry, academia, and R & D institutions.
- Can be customized for polar liquids or gases and fitted in pressure vessels.
- Ideal for measuring the thermal conductivity of nanofluids.

The successful Transient Hot-Wire technique is applied in the measurement of the thermal conductivity of liquids, by employing a thin Ta wire (actually two wires, to correct for end effects). The thermal conductivity of the sample fluid is determined by observing the temporal temperature rise of the immersed thin wire, when it is subjected to a step voltage. In this way, electrical current flows through the wire and heats it up, thus creating in the fluid a line source of essentially uniform heat flux per unit length that depends on the thermal conductivity of the fluid sample.

One of the main advantages of our technique, is that it produces the thermal conductivity of toluene and water (known to 0.5%) within this uncertainty, and without any calibration!

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