The Quasi-Steady Hot Wire/Hot Strip Technique and its ISO Uncertainty

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A new method is developed for the measurement of thermal conductivity [1, 2]. It combines characteristic advantages of steady-state and transient techniques but avoids major drawbacks of both these classes of methods. On the basis of a simple transient hot-wire (THW) or transient hot-strip (THS) arrangement, a direct indicating thermal-conductivity meter is realized by adding only two temperature sensors at different radial distances from the strip or wire. After a short settling time during which all transients die out the Quasi-Steady State (QSS) output signal which is the measure for the thermal conductivity is constant in time as is for steady-state instruments. No guard heaters are required because a QSS signal is not affected by homogeneous boundary conditions. Outer boundaries are free to change with time. Thus, there is no need to locate a time window as has to be done with the transient hot wire or transient hot strip techniques.
After a brief introduction to the new technique, the assessment of the QSS standard uncertainty of thermal conductivity according to the ISO GUM is presented. As has already been done in previous papers on the uncertainty of the transient hot wire [3] and transient strip techniques [4], first, the most significant sources of error are analysed and numerically evaluated. Then the results are combined to the overall uncertainty of 3.8%. Simultaneously, the present assessment is used as an aid in planning the experiment and in designing a QSS sensor of minimal uncertainty. This sensor is used to verify the above mentioned standard uncertainty from a run on the candidate reference material polymethyl methacrylate.

1. U. Hammerschmidt, A Quasi-Steady State Technique to Measure the Thermal Conductivity. *Int. J. Thermophys.* **24**, 1291-1312 (2003).
2. U. Hammerschmidt, Quasi-Steady State (QSS) Method: Uncertainty Assessment. submitted to *Int. J. Thermophys.*
3. U. Hammerschmidt and W. Sabuga, Transient Hot Wire (THW) Method: Uncertainty Assessment. *Int. J. Thermophys.* **21**, 1255-1278 (2000).
4. U. Hammerschmidt and W. Sabuga, Transient Hot Strip (THS) Method: Uncertainty Assessment. *Int. J. Thermophys.* **21**, 217-248 (2000).