P 2.2.1

Thermal conduction

P 2.2.1.1 Determining the heat conductivity of building materials using the single-plate method

P 2.2.1.2 Determining the heat conductivity of building materials with the aid of a reference material of known thermal conductivity

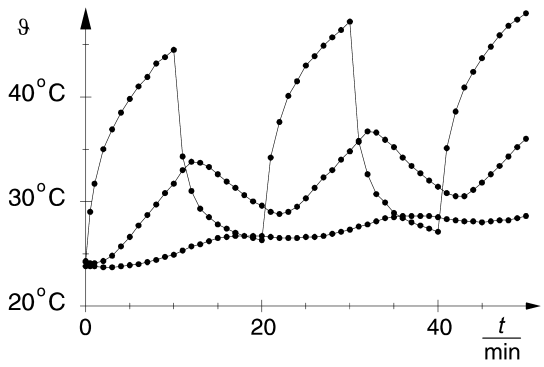
P 2.2.1.3 Damping of temperature variations using multi-layer walls

Determining the heat conductivity of building materials with the aid of a reference material of known thermal conductivity (P 2.2.1.2)

In the equilibrium state, the heat flow through a plate with the cross-section area A and the thickness d depends on the temperature difference $\vartheta_2 - \vartheta_1$ between the front and rear sides and on the thermal conductivity λ of the plate material:

$$\frac{\Delta Q}{\Delta t} = \lambda \cdot A \cdot \frac{\vartheta_2 - \vartheta_1}{d}$$

The object of the first two experiments is to determine the thermal conductivity of building materials. In these experiments, sheets of building materials are placed in the heating chamber and their front surfaces are heated. The temperatures ϑ_1 and ϑ_2 are measured using measuring sensors. The heat flow is determined either from the electrical power of the hot plate or by measuring the temperature using a reference material with known thermal conductivity λ_0 which is pressed against the sheet of the respective building material from behind.



Temperature variations in multi-layer walls (P 2.2.1.3)

Cat. No.	Description	P 2.2.1.1	P 2.2.1.2	P 2.2.1.3
389 29	Calorimetric chamber	1	1	1
389 30	Set of building materials for calorimetric chamber	1	1	1
521 25	Transformer 2....12 V	1	1	1
666 198	Digital temperature controller and indicator	1		
666 190	Digital thermometer with 1 input	1*		
666 209	Digital thermometer with 4 inputs		1	1
666 193	Temperature sensor NiCr-Ni	2	3	3
531 120	Ammeter, AC, $I < 2$ A, e.g. Multimeter LDanalog 20	1		
531 120	Voltmeter, AC, $U < 12$ V, e.g. Multimeter LDanalog 20	1		
313 17	Stopclock II, 60 s/30 min	1		1
450 64	Halogen lamp housing, 12 V, 50/100 W			1
450 63	Halogen lamp, 12 V/100 W			1
300 11	Saddle base			1
501 33	Connecting lead, 100 cm, black, Ø 2,5 mm^2	3	2	2
501 46	Pair of cables, 100 cm, red and blue	1		

* *alternatively:* digital thermometer with 4 inputs (666 209)

The final experiment demonstrates the damping of temperature variations by means of two-layer walls. The temperature changes between day and night are simulated by repeatedly switching a lamp directed at the outside surface of the wall on and off. This produces a temperature "wave" which penetrates the wall; the wall in turn damps the amplitude of this wave. This experiment measures the temperatures ϑ_A on the outer surface, ϑ_Z between the two layers and ϑ_I on the inside as a function of time.