Correlation between the resistance and the material of a wire

Set-up with the apparatus for resistance measurements

Objects of the experiment

1. Investigating the dependence of the resistance of a wire from its material.

Set-up

Apparatus

1 Apparatus for resistance measurements	550 57
2 Demo-Multimeter, passive	531 906
1 Power supply, 12 V, DC, 230 V	521 49
5 Connecting leads, 100 cm	500 444
2 Stand base, V-shape	300 02
2 Stand rods, 250 mm	300 41
2 Leybold multiclamp	301 01
2 Metal plate	from 686 50 ET5

Carrying out the experiment

- Connect the constantan-wire (d = 0,5 mm).
- Set a voltage of 0,5 V on the power supply.
- Read current and voltage from the multimeter and write it into the table.
- Repeat the measurement with a brass-wire of identical cross-sectional area and length.
- Calculate resistances R from voltages U and currents I using ($R = \frac{U}{I}$).

Measuring example

Material	Voltage U in V	Current I in A	Resistance R in Ω
Constantan	0,50	0,20	2,50
Brass	0,50	1,40	0,36

Evaluation

The resistance of a wire depends on its material.

Remark:

The material of an electrical conductor is characterized by a matter-specific quantity. That quantity is called specific electrical resistance:

Symbol: ρ Unit: $\frac{\Omega \cdot mm^2}{m}$.

The resistance of an arbitrary conductor can be calculated from its specific electrical resistance ρ, its length L and its cross-sectional area A using: $R = \rho \frac{L}{A}$.

Table values (at 20°C):

Constantan:

$\rho = 0{,}50\ \frac{\Omega \cdot mm^2}{m}$

Brass (37 % Zn, 63 % Cu):

$\rho = 0{,}07\ \frac{\Omega \cdot mm^2}{m}$

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