

Stefan-Boltzmann's law of radiation 3.5.01-01/15



What you can learn about ...

- Black body radiation
- Thermoelectric e. m. f.
- Temperature dependence of resistances

**Principle:**

According of Stefan-Boltzmann's law, the energy emitted by a black body per unit area and unit time is proportional to the power "four" of the absolute temperature of the body. Stefan-Boltzmann's law is also valid for a so-called "grey" body whose surface shows a wavelength-independent absorption-coefficient of less than one. In the experiment, the "grey" body is represented by the filament of an incandescent lamp whose energy emission is investigated as a function of the temperature.

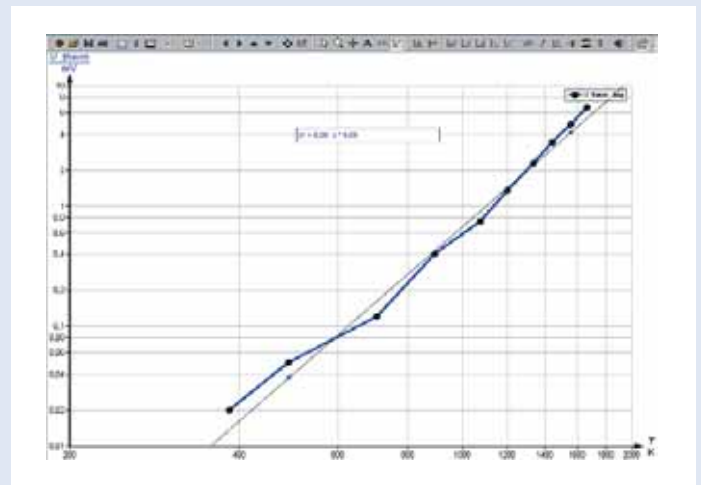
Set-up of experiment P2350115 with Cobra3

**What you need:**

Experiment P2350115 with Cobra3  
 Experiment P2350101 with amplifier

Optical profile bench, $l = 600$ mm	08283.00	1
Base for optical profile bench, adjustable	08284.00	2
Slide mount for optical profil bench, $h = 30$ mm	08286.01	2
Universal measuring amplifier	13626.93	1
Thermopile, Moll type	08479.00	1 1
Shielding tube for thermopile	08479.01	1 1
Variable transformer with rectifier 15 V-/12 V- , 5 A	13530.93	1 1
Lamp socket E 14, on stem	06175.00	1 1
Filament lamps, 6 V/5 A	06158.00	3 3
Connection box	06030.23	1 1
Resistor 100 $\Omega$ 2%, 1W, G1	06057.10	1 1
Digital multimeter 2010	07128.00	3 1
Connecting cable, 4 mm plug, 32 A, blue, $l = 50$ cm	07361.04	4 3
Connecting cable, 4 mm plug, 32 A, red, $l = 50$ cm	07361.01	4 2
Barrel base -PASS-	02006.55	2
Meter Scale, $l = 1000 \times 27$ mm	03001.00	1
Cobra3 BASIC-UNIT	12150.00	1
Power supply 12V/2A	12151.99	1
Data cable 2 x SUB-D, plug/socket, 9 pole	14602.00	1
Software Cobra3 Universal recorder	14504.61	1
PC, Windows® 95 or higher		

Complete Equipment Set, Manual on CD-ROM included  
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Thermoelectric e. m. f. of thermopile as a function of the filament's absolute temperature.

**Tasks:**

1. To measure the resistance of the filament of the incandescent lamp at room temperature and to ascertain the filament's resistance  $R_0$  at zero degrees centigrade.
2. To measure the energy flux density of the lamp at different heating voltages. The corresponding heating currents read off for each heating voltage and the corresponding filament resistance calculated. Anticipating a temperature-dependency of the second order of the filament-resistance, the temperature can be calculated from the measured resistances.