五、实验数据处理

实验1.稳态法测量不良导体的热导率实验

(1)原始数据记录

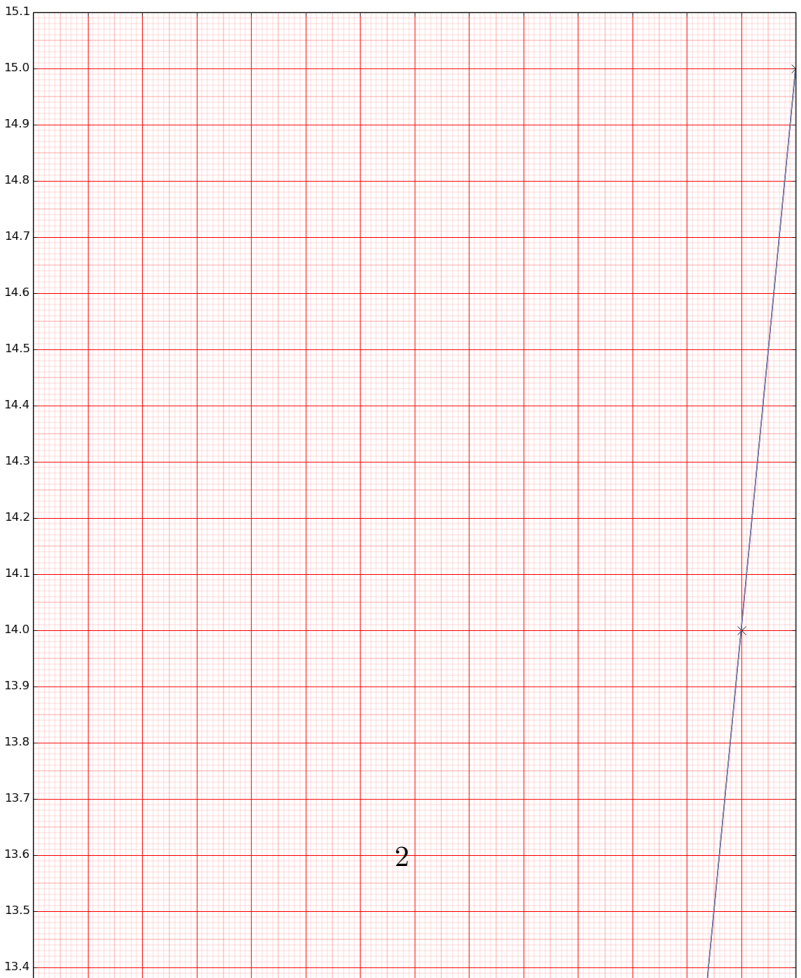
$m_p = 3.0g$
$c = 368J/(kg \cdot K)$
稳定状态下$\Theta_1 = 1.0mV, \Theta_2 = 2.0mV$

i	1	2	3	4	5	平均
h_P/mm	1.0	2.0	3.0	4.0	5.0	3
d_P/mm	11.0	22.0	33.0	44.0	55.0	33
h_B/mm	111.0	222.0	333.0	444.0	555.0	333
d_B/mm	1111.0	2222.0	3333.0	4444.0	5555.0	3333

散热过程中Θ_2随时间的变化:

时间t/s	0	30	60	90	120	150	180	210	240	270	300	330	360	390	420
Θ_2/mV	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0

(2)计算热导率


15.1
15.0
14.9
14.8
14.7
14.6
14.5
14.4
14.3
14.2
14.1
14.0
13.9
13.8
13.7
13.6
13.5
13.4

$$\frac{\delta\Theta}{\delta t} = mV/s$$

$$k = m_p c \frac{\delta\Theta}{\delta t} \frac{d_P + 4h_P}{d_P + 2h_P} \frac{h_B}{\Theta_1 - \Theta_2} \frac{2}{\pi d_B^2} = 0.0008103 W/(m \cdot s)$$

(3)不确定度的计算

$u(m_P) = \frac{0.01}{\sqrt{3}} g = 5.7735 \times 10^{-6} kg$

$u_a(h_P) = \sqrt{\frac{\Sigma(h_{Pi} - \overline{d_P})^2}{5 \times 4}} = 0.0007071m$

$u_a(d_P) = \sqrt{\frac{\Sigma(d_{Pi} - \overline{d_P})^2}{5 \times 4}} = 0.007778m$

$u_a(h_B) = \sqrt{\frac{\Sigma(h_{Bi} - \overline{d_B})^2}{5 \times 4}} = 0.07849m$

$u_a(d_B) = \sqrt{\frac{\Sigma(d_{Bi} - \overline{d_B})^2}{5 \times 4}} = 0.7856m$

$u_b(h_P) = u_b(d_P) = u_b(h_B) = u_b(d_B) = \frac{0.02}{\sqrt{3}} mm = 1.1547 \times 10^{-5} m$

$u(h_P) = \sqrt{u_a(h_P)^2 + u_b(h_P)^2} = 0.0007072m$

$u(d_P) = \sqrt{u_a(d_P)^2 + u_b(d_P)^2} = 0.007778m$

$u(h_B) = \sqrt{u_a(h_B)^2 + u_b(h_B)^2} = 0.07849m$

$u(d_B) = \sqrt{u_a(d_B)^2 + u_b(d_B)^2} = 0.7856m$

$\frac{u(k)}{k} = \sqrt{(\frac{u(m_P}{m_P})^2 + ((\frac{1}{d_P+4h_P} - \frac{1}{d_P+2h_P}) * u(d_P))^2 + ((\frac{4}{d_P+4h_P} - \frac{2}{d_P+2h_P}) * u(h_P))^2 + (\frac{u(h_B)}{h_B})^2 + (\frac{2u(d_B)}{d_B})^2}$
$= 0.5284$

$u(k) = k \cdot \frac{u(k)}{k} = 0.0004282 W/(m \cdot s)$

(4)最终结果

$$k \pm u(k) = (8 \pm 4) \times 10^{-4} W/(m \cdot s)$$