测金属丝杨氏模量(一) 3.20 CCD

北京地区重力加速度 $g = 9.801\ m\cdot s^{-2}$ $E = \frac{4mgL}{\pi d^2 \delta L}$.

m - 电子天平.

L - 米尺.

d - 千分尺.

~~$L = 1260.0\ mm \rightarrow 23.9\ mm = 1022.1\ mm$~~

$L = 101.80\ cm - 22.40\ cm = 79.40\ cm$.

测量金属丝直径. $d_0 = 0.00\ mm$.

i	1	2	3	4	5	6	7	8	9	10
d'/mm	0.323	0.322	0.322	0.322	0.321	~~0.325~~	0.323	0.322	0.324	0.321

~~平均~~

$\bar{d} = $ ~~0.323~~ 0.322 mm $\sigma_{\bar{d}} = 0.006$ mm

测量金属丝受外力拉伸后的伸长变化数据表.

i	$\sum m_i$/g	m_i/g	r_i/mm	r_i'/mm	$\bar{r}$/mm	$\delta L = (\bar{r}_{i+5} - \bar{r}_i)$/mm
0	—	0.00	2.20	2.19	—	—
1	199.99	~~200.00~~ 199.99	2.34	2.33	—	—
2	199.76	399.75	2.49	2.46	2.475	~~0.465~~ 0.465
3	199.91	599.66	2.60	2.59	2.595	0.455
4	199.99	799.65	2.71	2.70	2.705	0.455
5	199.73	999.38	2.80	2.83	2.815	0.465
6	199.55	1198.93	2.95	2.93	2.940	—
7	199.63	1398.56	3.05	3.05	3.050	—
8	199.94	1598.50	3.17	3.15	3.160	—
9	199.67	1798.17	3.28	3.28	3.280	—

$\bar{m} = 199.797$ g $\sigma_{\bar{m}} = 0.06$ g

$\overline{\delta L} = 0.460$ mm

$\sigma_{\delta L} = $ ~~0.002 mm~~ 0.003 mm.

$\Rightarrow \bar{E} = \frac{4mgL}{\pi d^2 \overline{\delta L}} = $ ~~4.3256 × 10^9~~ 1.6536×10^{11} Pa.

$\sigma_{\bar{E}} = \bar{E}\sqrt{\left(\frac{\sigma_m}{m}\right)^2 + \left(\frac{\sigma_L}{L}\right)^2 + 4\left(\frac{\sigma_d}{d}\right)^2 + \left(\frac{\sigma_{\delta L}}{\delta L}\right)^2} = 0.13 \times 10^{11}$ Pa.

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测金属的杨氏模量（二） 3.22 弯曲梁

$$E=\frac{Gl^3}{4kabh^3} \qquad G=mg$$

$\sigma_l=0.06$ cm.

l – 钢尺. ~~0.01 cm~~ 0.1 cm. 测1次（两侧相等）. $l=27.85$ cm.

~~a – 钢尺. 0.01 cm. 由于其均匀性相好. 测一次 $a=1.50$ cm~~

h – 螺旋测尺 ~~0.001 mm~~ 0.01 mm $d_0=-0.002$ mm.

i	1	2	3	4	5	$(\bar{h}-h_0)$
h/mm	1.530	1.523	1.531	1.514	1.532	~~$(\bar{h}-d_0)$~~ $=1.528$ mm

$\sigma_{测}=0.007$ mm

a – 游标卡尺. 0.05 mm

i	1	2	3	4	5	
a/mm	14.90	14.90	14.95	14.93	14.90	$\bar{a}=14.92$ mm

$\sigma_{\bar{a}}=0.03$ mm

测量装置示意. 1 mm.

i	m/g	x_i/mm	x_i'/mm	Δ/mm	λ'/mm	
0	0.000	45.50	45.4	0.0	0.0	← 小数点位置有误
1	200.39 (199.56)	44.6	44.5	0.9	0.9	
2	399.95 (200.94)	43.7	43.6	1.8	1.8	
3	600.89 (200.66)	42.8	42.7	2.7	2.7	
4	801.55 (200.08)	41.9	41.8	3.6	3.6	
5	1001.63 (200.13)	41.0	40.9	4.5	4.5	
6	1201.76	40.1	40.0	5.5	5.4	

$$\lambda=\frac{gl^3}{4Eabh^3}m \quad\Rightarrow\quad E=\frac{gl^3}{4kabh^3}$$

$k=4.4925\times10^{-4}$ kg^{-1} $r=0.999996$ $\sigma_k=0.0014\times10^{-4}$.

$\Rightarrow \bar{E}=2.134\times10^{11}$ Pa

2分 3.2