

YOUNG'S MODULUS OF COPPER WIRE

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FLAGS MOVED SO BOTH CHANGE SIGNIFICANTLY. FIX INITIAL FLAG SEPARATION AT 2.000m

Average radius of wire /m

1.85E-04

Strength of gravity /Nkg⁻¹

9.81

Flag 1 position /mm (minimal load 0.1 kg just to keep wire straight)

0

Flag 2 position /mm

2000

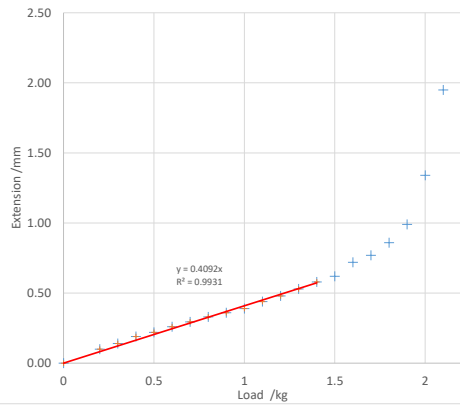
Inter flag distance (effectively unloaded) /m

2.000

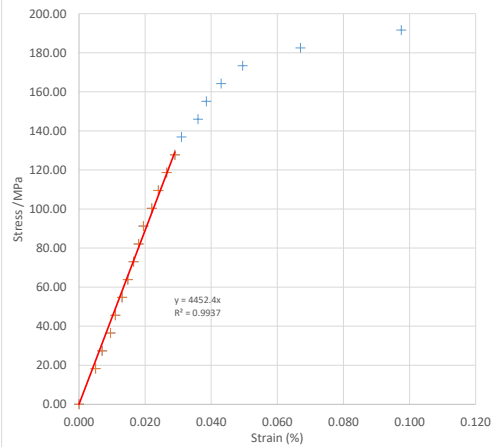
Masking tape flag displacements viewed using Russian eyepieces

Flag 1 displacement /mm	Flag 2 displacement /mm	Load /kg	Extension /mm (delta)	Stress /MPa	Strain %
0.00	0.00	0	0.00	0.00	0.000
0.05	0.15	0.2	0.10	18.25	0.005
0.12	0.26	0.3	0.14	27.37	0.007
0.15	0.34	0.4	0.19	36.50	0.010
0.18	0.40	0.5	0.22	45.62	0.011
0.20	0.46	0.6	0.26	54.74	0.013
0.22	0.52	0.7	0.30	63.87	0.015
0.25	0.58	0.8	0.33	72.99	0.017
0.28	0.64	0.9	0.36	82.11	0.018
0.29	0.68	1	0.39	91.24	0.020
0.32	0.76	1.1	0.44	100.36	0.022
0.33	0.81	1.2	0.48	109.49	0.024
0.36	0.89	1.3	0.53	118.61	0.027
0.38	0.96	1.4	0.58	127.73	0.029
0.41	1.03	1.5	0.62	136.86	0.031
0.44	1.16	1.6	0.72	145.98	0.036
0.47	1.24	1.7	0.77	155.10	0.039
0.52	1.38	1.8	0.86	164.23	0.043
0.56	1.55	1.9	0.99	173.35	0.050
0.67	2.01	2	1.34	182.48	0.067
0.77	2.72	2.1	1.95	191.60	0.098

Extension vs load for 0.37mm diameter copper wire

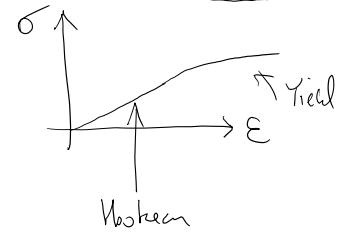


Stress vs strain curve for copper wire



$$Y = \frac{\sigma}{\epsilon}$$

σ ← Stress
ε ← Strain



Using a line of best fit for the Hookean region

$$\frac{\sigma / \text{MPa}}{\epsilon \times 100} = 4452$$

$$\therefore \frac{\sigma}{\epsilon} / \text{GPa} = 100 \times \frac{4452}{1000} = 445$$

\therefore Young's Modulus of Copper is $\approx 445 \text{ GPa}$

Textbook values:

<http://www.mit.edu/~6.777/matprops/copper.htm>

130 GPa

https://www.engineeringtoolbox.com/young-modulus-d_417.html

117 GPa