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Tensile Testing (AE 2610; Section A01; Group Y)

Objective: To analyze the stress-strain relationship of ductile metals under tensile loads. This experiment will use sensitive mechanical transducers and record data through manual effort and with `.csv` files.

Key Equations:

σ ~ Normal Stress P ~ Load Magnitude
A_o ~ Cross-Sectional Area L_o ~ Initial Length
δ ~ Elongation E ~ Young's (Elastic) Modulus
ε ~ Normal Strain A ~ Final Area
L ~ Final Length σ_p ~ Proportional Limit
σ_y ~ Yield Stress K ~ Strength Coefficient
n ~ Strain Hardening Exponent R ~ Resistance
S_g ~ Gauge Strain Factor σ_T ~ True Stress
ε_T ~ True Strain

$\sigma = P/A_o$ $\varepsilon = \delta/L_o$ $\sigma = E\varepsilon$ $A_o/A = L/L_o = 1+\varepsilon$

$\sigma_T = \sigma(1+\varepsilon)$ $\varepsilon_T = \ln(1+\varepsilon)$ $\sigma_T = K\varepsilon_T^n$

$\ln\sigma_T = \ln K + n\ln\varepsilon_T$ $\ln\sigma_T = \ln E + \ln\varepsilon_T$

$S_g = \frac{\Delta R}{\varepsilon R} \Rightarrow \varepsilon = \frac{\Delta R}{S_g R}$

Data to be Collected:

1) Reduced section dimensions (both specimens)
   A) Length, width, and thickness before testing
   B) Width/thickness of fracture region
   C) Width/thickness of uniformly deformed region
   D) Final length
2) Initial gauge lengths (L_0)
3) Two raw `.csv` files containing: (both specimens)
   A) Time
   B) Load
   C) Extensometer Strain

Test Specimen Dimensions: (L×W×H)

	Aluminum	Mystery
1	66.65 mm × 12.67 mm × 2.08 mm	65.32 mm × 12.82 mm × 1.98 mm
2	67.33 mm × 12.63 mm × 2.08 mm	64.71 mm × 12.83 mm × 2.06 mm
3	67.5 mm × 12.73 mm × 2.05 mm	64.78 mm × 12.77 mm × 2.05 mm
Avg	67.16 mm × 12.68 mm × 2.07 mm	64.94 mm × 12.81 mm × 2.03 mm

$L_o = 2.00$ in

Post-Test Dimensions: (fracture, uniform)

		Aluminum		Mystery	
1	L	75.25 mm		75.24 mm	
	W	11.91 mm	12.02 mm	9.12 mm	10.92 mm
	H	1.79 mm	1.92 mm	1.45 mm	1.84 mm
2	L	74.62 mm		77.50 mm	
	W	11.61 mm	12.02 mm	9.24 mm	10.88 mm
	H	1.81 mm	1.89 mm	1.59 mm	1.77 mm
Avg	L	74.94 mm		76.37 mm	
	W	11.76 mm	12.02 mm	9.18 mm	10.90 mm
	H	1.80 mm	1.91 mm	1.52 mm	1.81 mm

Observations:

- Measurement of 2024 specimen is EXTREMELY difficult due to curvature
- Calipers having issue holding a zero
- Extensometer is well-calibrated
- Aluminum secured in jaws, seems to have avoided slippage
- NO VISIBLE NECKING on plot
- Saved Aluminum_Monatonic_101.csv
- Mystery material is golden in color
- Measurements were of even poorer quality
- Minor slippage during test initialization
- Lots of noise present in data... slipping?
- Necking visible

- Saved as Mystery_Monatonic_11_1.csv
- Uh... nothing happened with a stress gauge yet data is "present" (0s) upon file inspection