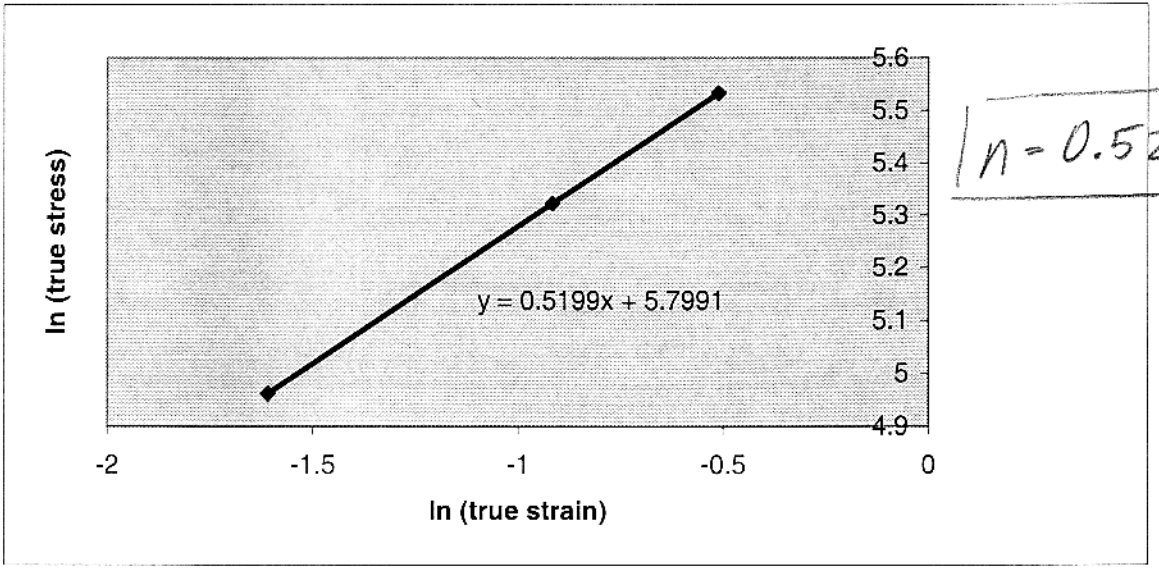
7-7

F (N)	dell (cm)	d (cm)	true stress (Mpa)	true strain	ln strue	ln str true
16240	0.6642	1.2028	142.9	0.199998	4.962323	-1.609449
19066	1.4754	1.0884	204.9	0.399983	5.322639	-0.916332
19273	2.4663	0.9848	253.0	0.59999	5.533488	-0.510843



$\boxed{n = 0.52}$

7-21 Calculate %CW for a 2 step reduction versus a single step reduction.

$$\%CW = \frac{(2)^2-(1)^2}{(2)^2} \times 100\% = \boxed{75\%}$$

regardless of the number of steps as long as no annealing has occurred in between steps. (Always "initial minus final")

7-23 Determine the final properties of a cold worked bar.

$$\%CW = \frac{(1)^2-(0.45)^2}{(1)^2} \times 100\% = 79.75 \text{ or } 80\%$$

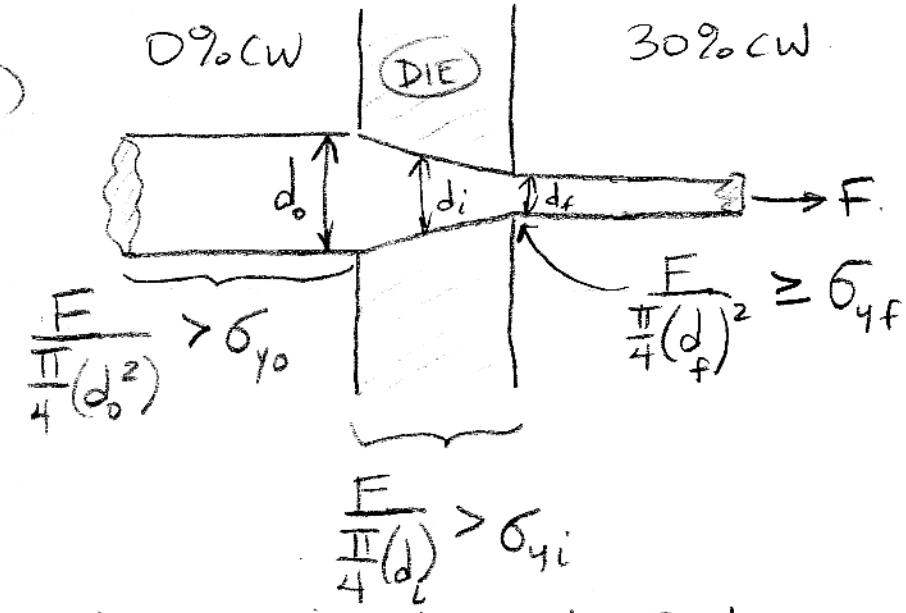
Using figure 7.24 $\boxed{TS \cong 105\text{ ksi} \quad YS \cong 68\text{ ksi} \quad \%EL = 1\%}$

7.44

(a) $\sigma_y = 20\,\text{ksi} \Rightarrow$ Fig 7-23 states we need 30% CW

$$\frac{d_o^2 - 1^2}{d_o^2} = 0.3 \Rightarrow d_o = 1.2\,\text{mm} = 0.047\,\text{in}$$

(b)



Determine largest F to ensure that $\sigma > \sigma_y$ always. Can only examine initial and final stages because die shape is unknown.

Initial: $\sigma_{yo} = 8000\,\text{psi} = \dfrac{F}{\frac{\pi}{4}(0.047)^2}$

$$F = 13.9\,\text{lbs}$$

Final: $\sigma_{yf} = 20000\,\text{psi} = \dfrac{F}{\frac{\pi}{4}\left(\frac{1\,\text{mm}}{25.4\,\text{mm/in}}\right)^2}$

$$F = 24.4\,\text{lbs}$$

Using $\boxed{F = 24.4\,\text{lbs}}$ will ensure that yielding continues throughout process

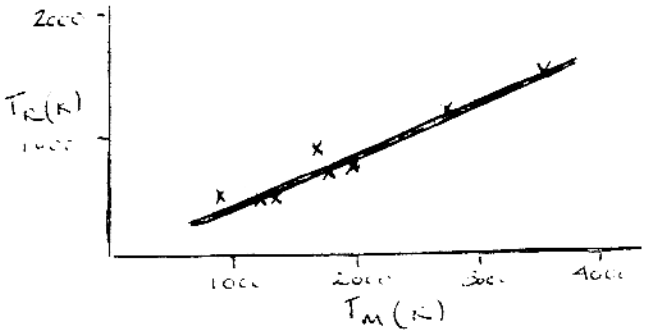
(c) Use σ_{uts} to check for failure $\Rightarrow \sigma_{uts}(0\%\,CW) = 16{,}000\,\text{psi}$

$$\sigma_i = \frac{F}{\frac{\pi}{4}(d_o)^2} = \frac{24.4}{\frac{\pi}{4}(0.047)^2} = 14{,}064\,\text{psi} < \sigma_{uts}$$

$\boxed{\text{WONT FAIL}}$

.66 Verify the relationship between melting temperature and recrystallization temp in °K.

	$T_m(K)$	$T_R(K)$
Al	933	423
Mg	923	473
Ag	1235	473
Cu	1358	473
Fe	1811	723
Ni	1726	873
Mo	2883	1173
W	3603	1473



Slope of the line ≅ 0.4

.68 Evaluate the CW process versus the process required to produce 0.2" diameter wire with $\sigma_y \geq 60$ ksi and %EL ≥ 5% using a maximum CW of 80%

For YS ≥ 60ksi CW ≥ 40%
For %EL ≥ 5% CW 45%
> CW = 42%

∴ final step of cw/anneal or HW has to be in this range and has to be cold work to achieve the final trade off of properties.

Examples.

CW / Anneal	HW
75% CW 2" → 1" diam / Anneal	HW 98% 2" → 0.263
75% CW 1" → 0.5" / Anneal	* CW 42% 0.263" → 0.2"
72.3% CW 0.5" → 0.263" / Anneal	
* 42% CW 0.263 → 0.2" / No Anneal	