MSE250 – Comments on Homework 3

Updated October 3, 2011

General Remarks

- Double-check your calculations
- Make sure your answers make sense.

  Funny examples:

  It would take 5 x 10^9 s for the diffusion process to occur. (That's almost 160 years)

  A bar of 200 m becomes 198.8 m after elongation/fracture.

- There is no need to include the question in your homework (unless you want to…)
- Convert to reasonable units!

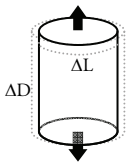
Bad	Good
142930 s	40 h
40000000 Pa	40 MPa

Diffusion

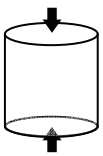
- Make sure you are doing the most efficient solution
  - eg. for #3 (5.30), since the rest of the variables are constant, a simple relationship can be set up: $(Dt)_{650C} = (Dt)_{850C}$. You could go through all the math of that second order DEQ, but it takes up precious time, unnecessary, and is more error-prone.
- Both the impurity being diffused as well as the host material affect the diffusion parameters (Q_d, D_0); be sure that your parameters have been tabulated for the correct impurity-host pair

Mechanical Properties

- When doing materials selection problems, the easiest way to verify whether a material meets the criteria is just use that material's properties (elastic modulus, Poisson ratio, etc.) to directly calculate whether it meets a particular criterion (e.g. if the criterion asks for Δ(thickness) < 0.008 mm, then just calculate how much each material widens/narrows and see if it is under 0.008mm!). Using the criterion to calculate some kind of "border" or "acceptable bounds" is often less efficient
- ** **Always check that applied stress is less than yield stress before using equations associated with the elastic region**
- Make sure that your sign is correct for applied stresses/forces (it's intuitive – just think!):

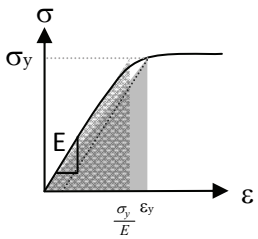


tensile
positive σ
positive ΔL (stretched)
negative ΔD (skinnier)



compressive
negative σ
negative ΔL (squished)
positive ΔD (fatter)

- Even if loading a rod causes it to fracture, one can still calculate its final length: just pretend that you glue the two pieces together and measure the total length. IMPORTANT: remember to account for elastic recovery when calculating the elongation of any material that has already undergone plastic deformation
- Even though the formulas are equivalent, realize that $\frac{1}{2}\sigma_y \varepsilon_y$ is going to be slightly different compared to $\frac{1}{2}\sigma_y^2 / E$:



If I took half a point off and said that one might be more accurate than the other, please come see me for a mark refund.

- Units of the modulus of resilience are J/m^3, not MPa (it is an energy density, even though it has the same dimensions as MPa)