Chem/MatS/ChEn 4223W

Assignment 13
Due: *In Lecture*, Monday, March 25

1. Using the approximation

$$E = \frac{\Delta\sigma}{\Delta\varepsilon},$$

calculate the elastic modulus for the *first* compression test of each of the polymers you tested in Lab 4 over the first 5% strain, using a stress-strain curve. In Lab 4, the dimensions of the variables in your load-compression measurements were Newtons (load) and mm (compression). In order to convert load into stress, expressed in Pascals (Pa), you will need to correct for the cross-section of your sample. Even though the diameter of a compressed specimen naturally increases as the sample is pressed, assume that your cross-sections remained constant over the first 5%. Keep in mind that you may also have to throw out some initial data points, especially if they represent the instrument approaching the sample rather than compressing it.

Express strain as the unitless fraction L/L_0, where L is change in thickness and L_0 is the original sample thickness.

Turn in copies of your stress-strain curves, showing all data over the entire run, in order to compare your 5% stress-strain calculation to the performance of the material over all strain. On the graphs, also plot lines that show the moduli you calculated above; these should look somewhat like tangents to the stress-strain curve near the origin. Label each line with the corresponding calculated modulus value. If either of your materials yielded (i.e., showed $E = 0$ anywhere along the curve), label this point.

2. How did your samples respond to repeated testing? In the second test, what fraction of applied force was required to compress the sample to the final test point relative to the first test?

3. On the Moodle Discussion Board, share your calculated polymer properties. You should post:

    - $\overline{M_n}$ and $\overline{M_w}$ values for both of your Lab 4 polymers, calculated using both GPC and NMR data. Attach your original GPC files to your post so that your classmates can use these if they wish. If you have reason to believe that one or more of your polymers terminated early, or contained multiple components (e.g., homopolymer and diblock in the same sample), note this in your post.
    - Elastic moduli over the first 5% compression. Attach your original load-compression data to your post.

Problem 3 should be posted to Moodle by the evening of Thursday, March 28.