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## Static Tensile Behavior of Polymers

### Objective:

The objective of this lab is to become familiar with the static tensile behavior of polymers. The stress strain behavior for samples which display crazing, shear banding, rubber modification, brittle, ductile failure and for elastomers will be observed. Data as a function of crosshead speed will also be observed. The dependence of tensile and shear failure on notch type will be determined for a brittle and a ductile sample.

### Instruments to be used:

Instron mechanical tester (Departmental)

Instron is Located in the High Bay area between Baldwin and Rhodes

Doug Bowling has the key

Charpy Impact Tester

Impact Tester is Located in Procesing Lab Across From 413 Rhodes

USE EXTREME CAUTION WHEN USING THE IMPACT TESTER!!

### Materials:

Tensile test bars of polycarbonate (2 molecular weights), polystyrene, high impact polystyrene, polyethylene of several types (HDPE, LLDPE, LDPE) and a sheet of elastomer (PDMS) will be investigated.

### Procedure:

- 1) Perform tensile tests till failure on all samples at 3 cross head speeds.
- 2) Repeat these tests with a notch cut in the sample center. Try different notch sizes.
- 3) For the polystyrene sample perform a compression test using the Instron.
- 4) Perform Charpy impact tests on samples.
- 5) Repeat these tests with a notch cut in the samples as in part 2).
- 6) Calculate the molecular weight between crosslinks for the elastomer sample.

### Analysis:

- 1) Make stress strain plots for all samples studied.
- 2) Determine the Young's Modulus, yield strength and strain, failure stress and strain.
- 3) Calculate the toughness (energy absorbed) by each sample.
- 4) Determine the impact strength for each sample.

### Questions:

- 1) Describe all features of the stress strain curves observed.
- 2) How do these features relate to deformation mechanisms observed in polymers, crazing and shear banding?
- 3) Describe brittle and ductile failure in polymers and categorize each sample investigated in terms of failure mechanism.
- 4) Explain why the notch type effected the results.
- 5) Explain why the crosshead speed effected the results.
- 6) Explain the differences between compressive and tensile loading for the polystyrene sample. Did the sample yield by crazing in compression?