

Group Work Assignment #3

November 2, 2009

15 points

Work in a small group of 2-4. Each person completes must complete assignment/fill in paper.
Hand in at end of class.

Name (Print)	Signature

Each person should have a piece of Parafilm, a newspaper (or something with printed text) and a Tootsie Roll.

1. Complete the following questions.
2. Please turn in your assignment at the end of class.

Necking in Polymers

Objective: To observe the mechanical properties of polymers. Execute a “tensile test” on Parafilm® and observe behavior

Materials: Parafilm, The Battalion

Procedure:

1. Take the piece of Parafilm and hold about a half inch over the text of the newspaper.
2. Very, very slowly, pull the ends (i.e. put it in tension). Watch what happens.
3. The sample will slowly begin to neck (narrow perpendicular to force).
4. Notice that the **text** under the **necked region** seems **blurry** whereas the text underneath the **area which is not necked** is **clear**.
5. As you continue to pull to an “almost fractured state”, the Parafilm will become more difficult to stretch further.

Explanation: Use back of the page.

1. Explain the behavior of Parafilm (as mentioned in point 4) on the basis of molecular structure with respect to tension. Note: Parafilm is relatively low MW PE and is a semi-crystalline thermoplastic.

2. Why does the sample get relatively **more difficult to stretch** right at the end (i.e. just before fracture)?

3. Draw a typical **stress-strain curve** for Parafilm in tension. Label: (1) stress, (2) strain, (3) necking, (4) yield strength, (5) tensile strength, (6) fracture, (7) elastic modulus, (8) %EL at yield, (9) %EL at break, (10) elastic deformation, (11) plastic deformation.

1. Application of stress (i.e. tension forces) will change the conformation of thermoplastic semi-crystalline polymer chains.

Relative clarity of region which is “not necked”

Until the on-set of necking, amorphous polymer chains are highly disordered. Amorphous polymers are typically transparent because light can pass through.

Relative opaque character of “necked” region:

After necking, amorphous polymer chains have been stretched and aligned with one another and light cannot pass through as well.

2. There is an increase in strength is due to the amorphous region chains and crystalline blocks becoming highly orientated or aligned.

