Tensile Behavior of Polymeric Materials

1. Aim

The aim of this experiment is to understand the *mechanical* properties of different materials by plotting their stress-strain curve, which is created through force-displacement curve using area and length value of speciment. Force-displacement curve can be obtained from tensile test.

2. Background

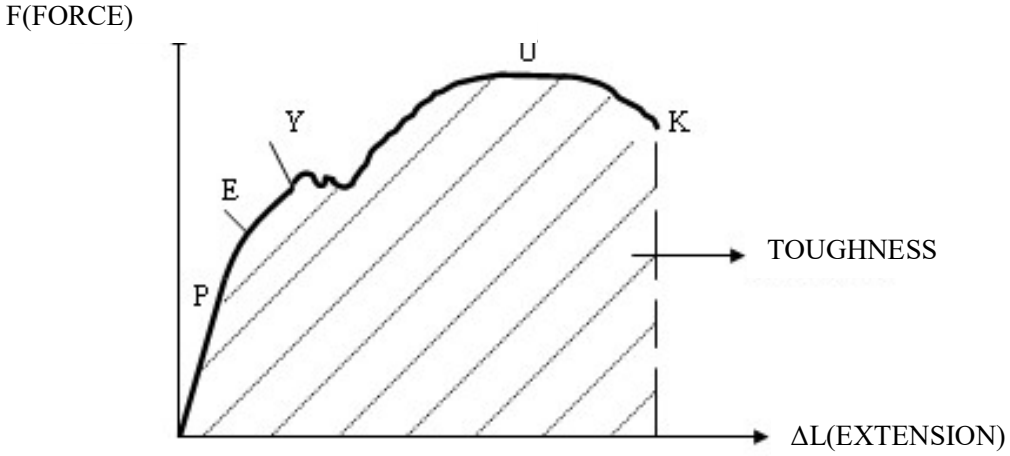

Figure.1

The materials are elastic up to point P, that is, when the applied force is lifted from the top of the material, the material returns to its original length. At the point E the material loses its flexibility and when the plastic deformation starts and the residual force is removed, the material undergoes a permanent deformation during the first longitudinal period. Y yield point is the yield strength point. If the material flowing after Y point is subjected to the retraction test, The point U is the tensile strength. At the point where the defects of the material (eg Dislocations, etc.), which are called the material shrinkage, are beginning to be thinned, this is called abrasion. The material breaks at the point K. The area under the force-elongation curve is equal to the energy required to decay that sample; It is called toughness.

"Duct" has a "brittle" structure if it has undergone a significant deformation. A specific example of ductile material is Gold (Au), which is very thin.

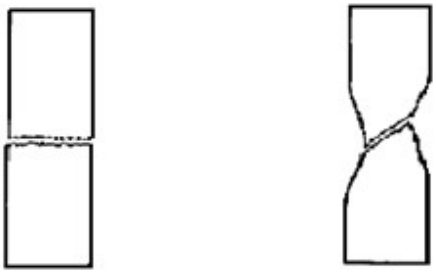

Figure2. (a) Rupture of brittle materials (b) Rupture of elastic materials.

3. Materials

The test specimens are 5 different polimers: PCL, PU, TEFLON, PU_L_GLU , Nylon 66. Testing device is SHIMADZU AGS-X-10kN Precision Universal / Tensile Tester.

4. Methods

Samples diameters will be measured before the test and the effective area will be calculated. Samples will be placed between two terminals of the tensile testing device. Materials will be tested with 10mm/min rate. Using the force-displacement graph gathered from the device and using the measured area and length values of samples, materials stress-strain behaviour will be plotted. From the graph the table given below will be filled and added into results section of the experiment report. And the comparison of materials is needed.

	PCL	PU	TEFLON	PU_L_Glu	Nylon 66
Yield Strength [Pa]					
Modulus of Elasticity [Pa]					
Elasticity (Pa, J / m ^ 3)					
Ultimate Tensile Strength [Pa]					
Ductility					
Breaking Strength[MPa]					
Toughness (Pa, J / m3)					
Percent Elongation at Break (%)					

5.References

[1] Smith,W.F., Principles of Materials Science and Engineering - 2nd Edition, McGraw Hill, 1990,