

# Lab 6: Tensile Testing

## 1. Introduction

The mechanical properties of materials are determined by performing carefully designed laboratory experiments that replicate as nearly as possible the service conditions. In the real life, there are many factors involved in the nature in which loads are applied on a material. The following are some common examples of how these loads might be applied: tensile, compressive and shear, just to name a few. These properties are important in materials selections for mechanical design. Other factors that often complicate the design process include temperature and time factors.

The topic of this lab is confined to the tensile property of polymers. Figure 6.1 shows a tensile testing machine, which looks similar to the one used in this lab. This test is a destructive method, in which a specimen of a standard shape and dimensions (**prepared according to *ASTM D 638*: standard test method for tensile properties of plastics**) is subjected to an axial load. As shown in Figure 6.1, during a typical tensile experiment, a dog-bone shaped specimen is gripped at its two ends and is pulled to elongate at a determined rate to its breakpoint; a highly ductile polymers may not reach its breakpoint. The tensile tester used in this lab is manufactured by Shimadzu Corporations (model *AJS-J*)<sup>1</sup>. It has a maximum load of 5 kN and a variable pulling rate. The setup of the experiment could be changed to accommodate different types of mechanical testing, according to the ASTM standard (e.g. compression test, etc).

For analytical purposes, a plot of stress ( $\sigma$ ) versus strain ( $\epsilon$ ) is constructed during a tensile test experiment, which could be done automatically on the software provided by the instrument manufacturer.



Figure 6.1. A photograph of a tensile machine (Shimadzu, Autograph AG-10TC).<sup>2</sup>

<sup>1</sup> The website of the Austrian Research Center, Materials and Technology: "<http://www.arsc.ac.at/AMTT/reports/report47.pdf>"

# Lab 9 Tensile Testing Materials Science And Engineering

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