Tensile Strength of a Specific Specimen Determined with a UTM (25KN)

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Abstract
The goal of this experiment is to apply a tensile force to a test specimen until the specimen is pulled to failure. The computer will track the properties during the application of the tensile load and produce a stress/strain curve that will allow for the determination of several values, including the material's modulus of elasticity. Any solid body will bend totally elastically if the load is small enough. As soon as the load is released, a solid that has been elastically deformed will revert to its original shape. On the other hand, the material may become permanently distorted if the load is too great. The first section of the tension curve that can be found as soon as the load is released is called. The aim of this experiment is to draw a test specimen to failure by applying a tensile force to it. The computer will track the properties during the application of the tensile load and produce a stress/strain curve that will allow for the determination of several values, including the material's modulus of elasticity.

Keywords: Stress, UTM, Elasticity, Plasticity, Ultimate Tensile Stress.

1. Introduction

The tensile strength is significantly lower than the compressive and shear strengths. Therefore, the tensile strength is frequently disregarded in conventional mechanics and engineering practice., the tensile strength is one of the key characteristics has been extensively utilized in both theoretical studies on frost heave and frozen engineering design For instance, mild permafrost zones are extensively spread throughout the Tibetan Plateau, Both the direct and indirect tensile methods can be used to test the tensile strength . The tensile strength of was previously studied using the UTM in the direct tensile method, Young's modulus, often known as the modulus of elasticity, is a material constant that represents the stiffness of a substance. It is derived from a specimen that has undergone uniaxial stress (tension, compression, or bending) by plotting the stress against strain. It makes use of the elastic modulus in addition to other material constants in constitutive equations relating strain to stress in increasingly intricate circumstances. Beams are subjected to bending tests utilizing the three point loading system. Usually, the easiest way to find the elastic modulus is to do a basic tensile test. Refer to Figure 1 for instance, displays a cylindrical test specimen under uniaxial tension. Two points of reference, defined as a gage length, and spaced Lo apart. When calculating engineering stress, ó, the load.

1) Stress= load/area (P/A)   Strain= dl/L
(Modulus of elasticity)   E= Stress/strain

2. Experimentation

The electro-mechanical test system of the tensile testing apparatus uniformly applies uniaxial loading to test items. In terms of its uses and capacities, it is all-purpose. The apparatus carries out tests of load against elongation, or stress against strain, which entail grasping specimens and manipulating forces ranging from several ounces to several thousand pounds. Spanning from fine fibres to strong metals or composites, and calculating the forces and deformations, or strains and stresses. Calculating the strains and stresses is achieved by employing extremely sensitive strain and load transducers that provide an electrical signal that is in line with the amount of strain or tension imposed. This electrical signal is digitalized and measured. After wards processed for strain, stress, and other computed material presentation, analysis, and report.

Figure 1 Apparatus

3. Materials and Equipment

1. Tensile testing machine
2. Test specimens
3. Micrometer
4. Callipers

Objective: The purpose of this experiment is to measure the modulus of elasticity (Young's modulus) of an aluminium beam by loading the beam in cantilever bending

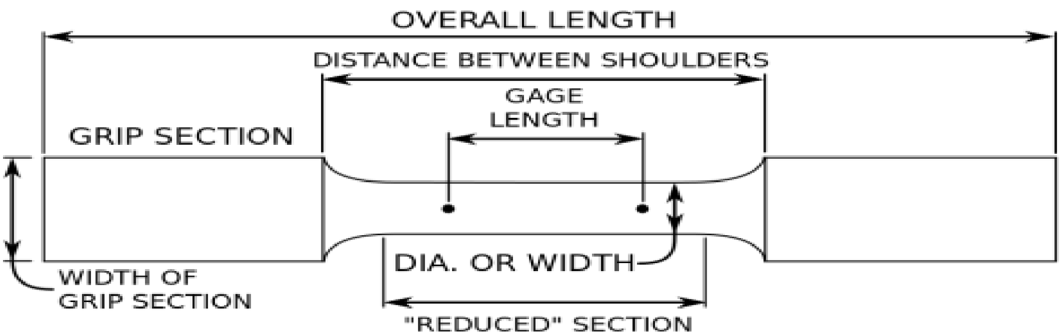

Figure 2Tensile stress test

4. Result

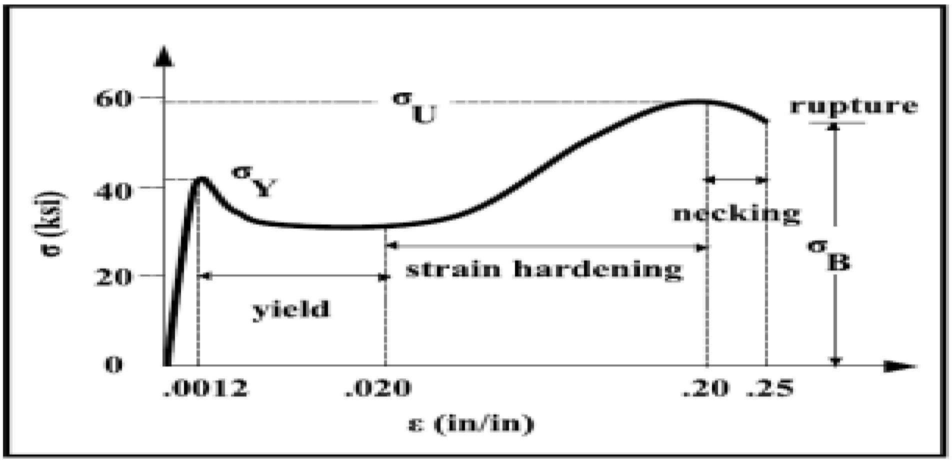

Figure 2. A stress-strain curve for a ductile material.

Depending on the material, the stress-strain curve's form can alter when the specimen is loaded at a different pace or is exposed to temperature changes. Materials are frequently categorized as brittle or ductile. Normal temperature yields for ductile materials whereas the characteristic of brittle materials is that they break without any obvious previous alteration in the elongation rate.

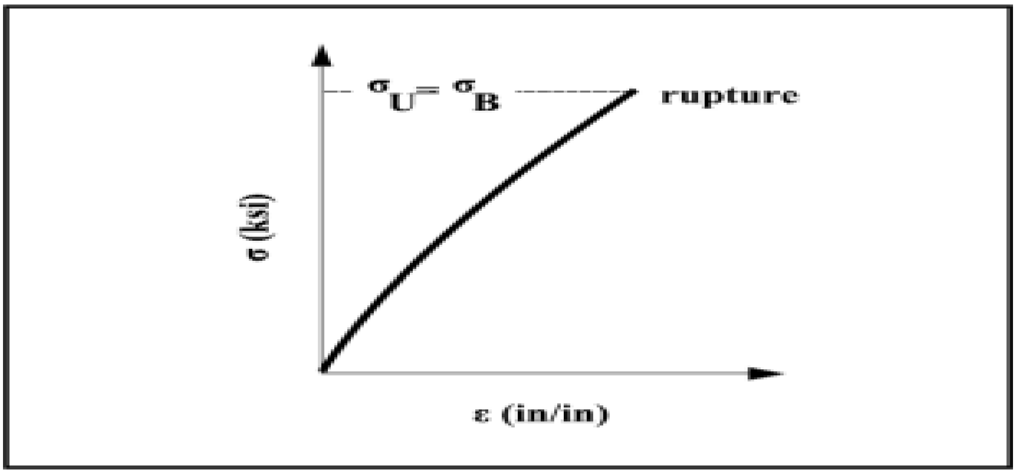

Figure 3. A stress-strain curve for a brittle material.

When a ductile material is used, the specimen yields, strain hardens, and experiences elastic deformation up until the maximum load is applied. Failure takes place along the planes of highest shear stress, and necking happens before rupture. The stress, óy, at which yield is commenced is referred to as the yield stress in Figure 3. The stress, óu, that results from applying the highest possible load to The specimen is referred to as the strongest possible. The rupture-corresponding stress, óB, is characterized as the breaking power. When it comes to the brittle material shown in Figure 3, there is no distinction between the ultimate power as well as breaking power. Necking is little, and failure occurs along

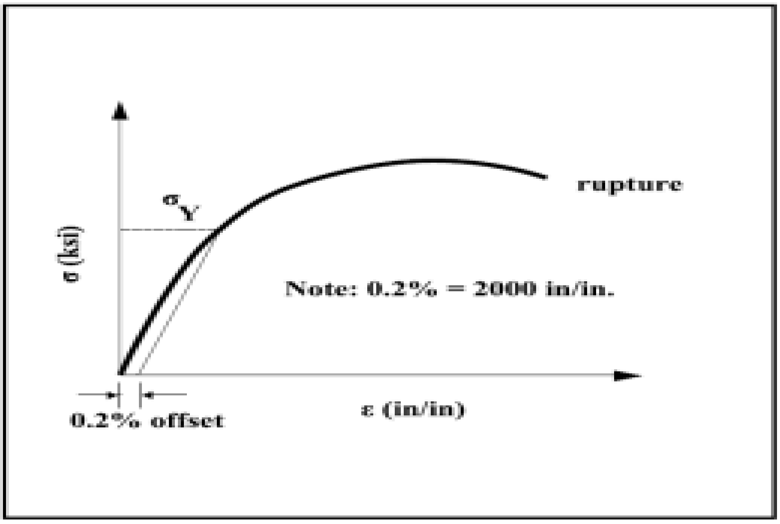

Figure 4 Offset methods used to determine yield stress of material

The major planes perpendicular to the highest normal stress. The elastic modulus can be found using a variety of techniques, including the secant and tangent approaches, because the slope of the elastic component of the stress versus strain curve frequently varies. When the point of yielding is not A well-defined approach for calculating yield stress is the 0.2% offset method. As demonstrated in Fig. 4 Starting from a strain value of ε = 0.2% (or ε = 0.002), óy is derived by drawing a line parallel to the first straight-line segment of the stress-strain diagram. It defines the yield stress.as the location on the stress versus strain curve where this line connects

5. Conclusion

In materials science and engineering, tensile testing with a UTM is a flexible and vital instrument. It offers vital information that guides decisions about materials, designs, quality assurance, and research and development, ultimately enhancing the performance and safety of a broad range of goods and buildings.

References:

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