TENSILE TEST

INTRODUCTION:-

A tensile test, also known as tension test, is probably the most fundamental type of mechanical test you can perform on material. Tensile tests are simple, relatively inexpensive, and fully standardised. By pulling on something, you will very quickly determine how the material will react to forces being applied in tension. As the material is being pulled, you will find its strength along with how much it will elongate.

OBJECTIVE:-

To determine the strength and other properties of various materials and other several elastic and plastic properties of various materials.

APPARATUS:-

A Universal Testing Machine, Mild steel specimen, vernier calliper/micrometer, dial gauge and graph paper.

THEORY:-

The tensile test is a test performed to know the ductility of the particular material. In practical, the test is carried out on universal testing machine (also called the UTM). When tension is applied to a particular member, the stresses are developed in the member at the centre. At a particular point of time during the testing, the member breaks.

Young's modulus: Young's modulus is defined as the ratio of stress to strain. It is denoted by 'E'.

Tensile stress: Tensile stress is the stress state caused by an applied load that tends to elongate the material in the axis of the applied load, in other words the stress caused by pulling the material. The strength of structures of equal cross sectional area loaded in tension is independent of cross section geometry. Materials loaded in tension are susceptible to stress concentration such as material defects or abrupt changes in the geometry. However, materials exhibiting ductile behaviour (metals for example) can tolerate some defects while brittle materials (such as ceramics) can fail well below their ultimate stress.

Yield strength: Yield strength is the lowest stress that gives permanent deformation in a material. In some materials, like aluminium alloys, the point of yielding is hard to define, thus

it is usually given as the stress required causing 0.2% plastic strain. This is called a 0.2% proof stress.

Tensile strength: Tensile strength or ultimate tensile strength is a limit state of tensile stress that leads to tensile failure in the manner of ductile failure (yield as the first stage of failure, some hardening in the second stage and break after a possible "neck" formation) or in the manner of brittle failure (sudden breaking in two or more pieces with a low stress state). Tensile strength can be given as either true stress or engineering stress.

Strain: Strain is defined as the ratio of deformed length to the original length.

PROCEDURE:-

1. The load pointer is set at zero by adjusting the initial the initial setting mode.
2. The dial gauge is fixed for measuring elongation of small amounts.
3. Measure the diameter of the test piece with the help of a vernier calliper at least at three pieces and determine the mean value. Also mark the gauge length.
4. Now the specimen is gripped between the upper and middle cross head jaws of the machine.
5. Start the machine and the specimen is gradually loaded. Note down the load and its corresponding dial gauge reading. The observations are taken until the specimen breaks
6. Plot the graph between stress vs. strain.

OBSERVATIONS:-

1. Initial cross sectional area of specimen, a_i =
2. Initial length of the specimen, l_i =
3. Ultimate load after specimen breaks =
4. Final length of the specimen after breaking, l_f =
5. Cross sectional area at the breaking place, a_f =

RESULT:-

1. Ultimate tensile strength =
2. Percentage elongation = $((l_f - l_i)/ l_i) \times 100$ =
3. Modulus of elasticity =
4. Yield stress =
5. Percentage reduction in area = $((a_i - a_f)/a_i) \times 100$ =

PRECAUTIONS:-

1. The specimen should be prepared in proper dimensions

2. The specimen must be properly placed between the jaws.
3. Take the readings carefully.
4. Stop the machine after the specimen fails.

REFERENCES:-

http://www.instron.in/wa/applications/test_types/tension/default.aspx
http://en.wikipedia.org/wiki/Tensile_strength
http://civilx.unm.edu/laboratories_ss/mechmat/tensilesteel.html
"Strength of materials" by Dr. R.K Bansal

QUIZ:-

1. Which steel have you tested? What is its carbon content?

2. In what region of a stress vs. strain graph do you find Young's Modulus?

3. Why do you think we remove the extensometer after yielding occurs?

4. What general information is obtained from the tensile test regarding the properties of the material?

5. Which stress have you calculated: Nominal stress or true stress?

6. What kind of fracture has occurred and why?

7. Which is the most ductile material? What is its elongation?