

Design and Material selection

Experiment 2

Tensile Test

The tensile test is one of the most important mechanical tests through which many important engineering information can be obtained that determine the mechanical behavior of materials during use, including [73]:-

- A. Yield stress.
- B. Ultimate tensile strength.
- C. Modulus of elasticity.

When a particular load is applied on a test sample so that it conforms to the it's longitudinal axis, it will undergo a certain elongation depending on the amount of force applied. So that we get geometric curve called stress-strain curve [73] .

The stress can be expressed in terms of the following relationship [73]:-

$$\sigma = \frac{F}{A} \quad \text{..... (2-8)}$$

Where:-

σ : the stress and it's unit (N/m²).

F: the force applied on the sample to cause elongation along the axis of the sample and it's unit is (N).

A: is a cross-sectional area of the sample and it's unit (m²).

While strain denoted by ϵ and is expressed in the following relationship [74]:-

$$\epsilon = \frac{\Delta L}{L_o} = \frac{L - L_o}{L_o} \quad \dots\dots\dots (2-9)$$

Where:-

L: elongation (final length of the sample).

L_o: initial length of the sample (primary).

ΔL : amount of change in length.

Strain is divided into two types (elastic strain and plastic strain), and the ratio between the stress applied on the material and the resulting strain in the elastic zone of the stress – strain curve is constant ratio called modulus of elasticity or young's modulus, which has the symbol (E) is measured in units of (N/m²) and is expressed in the following relationship [75]: -

$$E = \frac{\sigma}{\epsilon} = \frac{P/A}{\Delta L/L_o} = \frac{PL_o}{\Delta LA} \quad \dots\dots\dots (2-10)$$