Mechanical property testing of metallic materials in LTAD

The mechanical properties of metallic materials are essential in the mechanical design phase, in product quality control or in the identification of causes for failure of these components. In general, mechanical tests can be classified as either destructive or non-destructive. They can still be static or dynamic. The mechanical tests available at the Friction and Wear Technology Laboratory of the Federal University are presented in this section.

Among the mechanical properties, hardness, without a doubt, is one of the most widespread. This is due to the relative ease in its execution, which can even be performed in the field without being destructive.

In the laboratory, the hardness can be determined in the part itself or, depending on the case, in a sample of the part. This sample must be removed with due care so that the removal process does not alter its mechanical properties.

Hardness tests can be performed at different scales. The most common are Brinell, Rockwell and Vickers. The choice of the scale to be used depends on the material being tested, the purpose of the tests, and other factors. For the investigation of the hardness of different phases in a microstructure, the most common scale is Vickers microhardness, with loads typically below 2 kgf.

The tensile properties are obtained on tensile machines as shown in **Fig. 1**. The dimensions of the specimens, as well as all the characteristics of the test, are defined by standards such as ASTM, ISO, API, Etc. **Fig. 2** shows the results of a tensile test in a low carbon steel, from which the values of yield strength and tensile strength can be deduced. These tests are conducted at a slow loading rate. However, in order to evaluate the ability of the material to withstand dynamic loads, fatigue tests or fracture toughness tests can be performed on the same machines.

Instead of evaluating the samples of a component, one can still evaluate the mechanical properties of the component as a whole. Thus, facilities with higher load capacity are used, as shown in **Fig. 3**, where the load can reach up to 700 kN (70 tf).

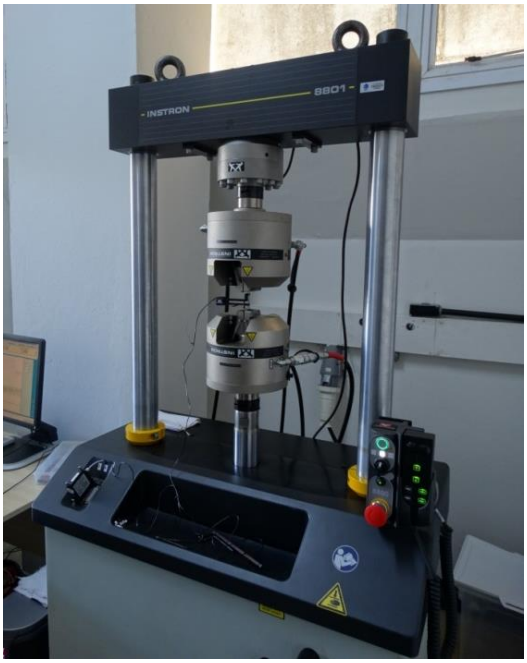

Fig. 1 – Tensile test machine with a load capacity of 100 kN.

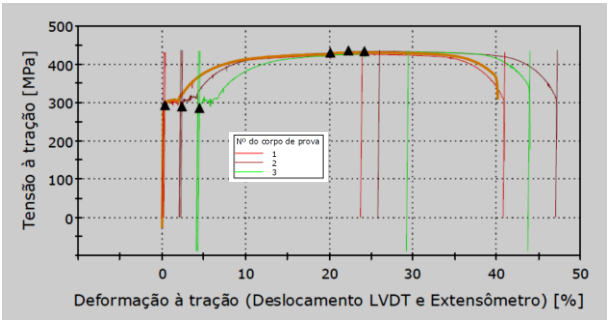

Fig. 2 – Engineering stress-strain diagram for a low carbon steel.

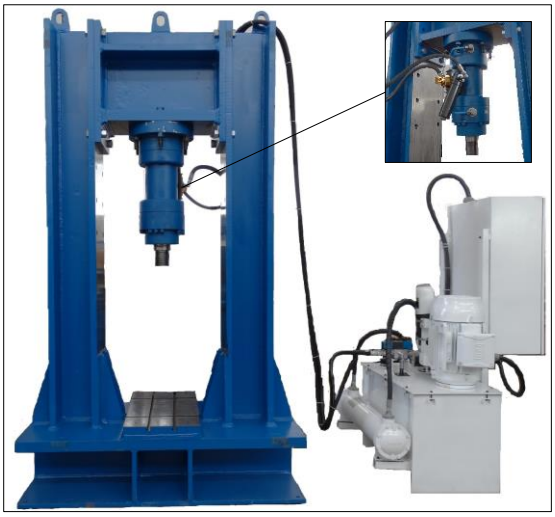

Fig. 3 – Fatigue test machine (up to 700 kN).

To see other tests for mechanical properties that can be performed at the LTAD, visit our website (address below).

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