ME 212 LABORATORY EXPERIMENT #4

IMPACT TESTING

1. INTRODUCTION:

A metal may be very hard (and therefore very strıng and yet be unsuitable for applications in which it is subjected to sudden loads in service. Materials behave quite differently when they are loaded suddenly than when they are loaded more slowly as in tensile testing. Because of this fact, impact test is considered to be one of the basic mechanical tests (especially for ferrous metals).

The term brittle fracture is used to describe rapid propagation of cracks without any excessive plastic deformation at a stress level below the yield stress of the material. Metals that show ductile behavior usually can, under certain circumstances, behave in a brittle fashion. The stress needed to cause yield rises as the temperature falls. At very low temperatures, fracture occurs before yielding.

Impact tests are used not also to measure the energy absorbing capacity of the material subjected to sudden loading; but also to determine the transition temperature from ductile to brittle behavior.

2. THEORY:

Pendulum Impact Test:

In this test the specimen is positioned across the lowest point in the path of a striker mounted at the end of a pendulum as shown in Figure 1. The striker, having been initially lifted to a specific height h1, and then released, swings against the specimen and breaks it. The striker continues its swing to the other side of the specimen to a height h2. Clearly the difference between the two heights multiplied by the weight of the striker corresponds to the amount of energy that is absorbed in fracture.

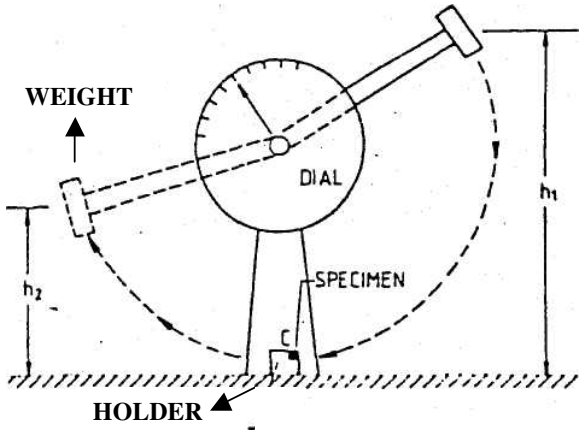

Figure 1. Schematic of a conventional Pendulum Impact Tester

Izod Impact Test:

In the Izod impact test, the test piece is a cantilever, clamped upright in an anvil, with a V-notch at the level of the top of the clamp. The test piece is hit by a striker carried on a pendulum which is allowed to fall freely from a fixed height, to give a blow of 120 ft lb energy. After fracturing the test piece, the height to which the pendulum rises is recorded by a slave friction pointer mounted on the dial, from which the absorbed energy amount is read.

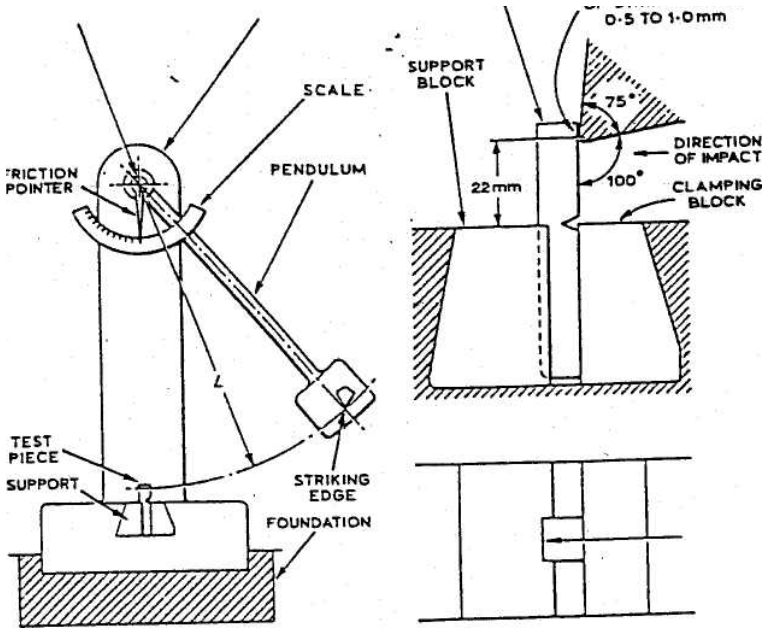

Figure 2. Basic Principle of Izod Impact Test

Charpy Impact Test:

The principle of the test differs from that of the Izod test in that the test piece is tested as a beam supported at each end; a notch is cut across the middle of one face, and the striker hits the opposite face directly behind the notch.

When the results of a number of tests performed in different temperatures are plotted, ductile-to-brittle transition curves, as in Fig. 3, may be obtained. As the temperature is reduced through the transition range, the fracture surface changes from one having a 'fibrous' or 'silky' appearance with much distortion at the sides, to one of completely crystalline appearance with negligible distortion. There is a strong correlation between the energy absorbed and the proportion of the cross-section which suffers deformation in fracture, and the fracture surface is frequently described in terms of the percentage of its area which is crystalline in appearance. Typical fracture appearances with crystallinity increases as the temperature is reduced.

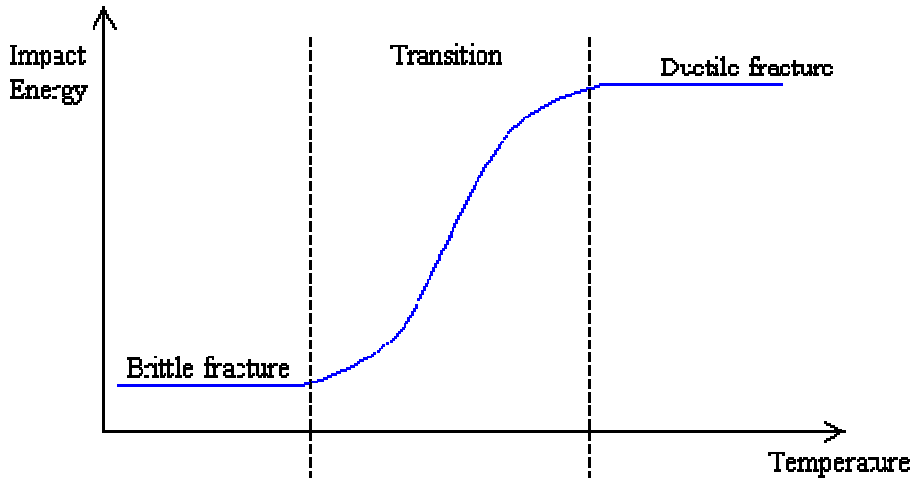

Figure 3: Schematic Presentation of the Ductile-to-Brittle Transition Curve.

3. TASKS:

1. What are the uses of the impact test?

2. What is the diffrence between Charpy and Izod Impact tests? Which one is preferred in which case?

3. What is the use of the inspection of the fracture surface to determine the percentage of the shiny surface?

4. The gauge of the Impact Testing Apparatus shows 52 divisions. Calculate the amount of energy adsorbed per unit surface prior to fracture. Remeber that 1 division corresponds to 2 Joules and the fracture surface is 8 mm x 10 mm, not 10 mm x 10 mm.