

UNIT-5

MECHANICAL PROPERTIES AND DEFORMABLE MECHANISM

5.4 HARDNESS TESTS :

It is defined as the resistance to indentation. In this method of measuring the hardness. In this method of measuring the hardness of metals is by determining the resistance offered to the indentation.

They are three types of hardness test :

- Brinell Hardness test
- Rockwell Hardness test
- Vicker's hardness test

Types of hardness are :

- Indentation hardness
- Rebound hardness
- Screen hardness
- Cutting hardness
- Abrasive hardness

5.4.1 Brinell hardness Test :

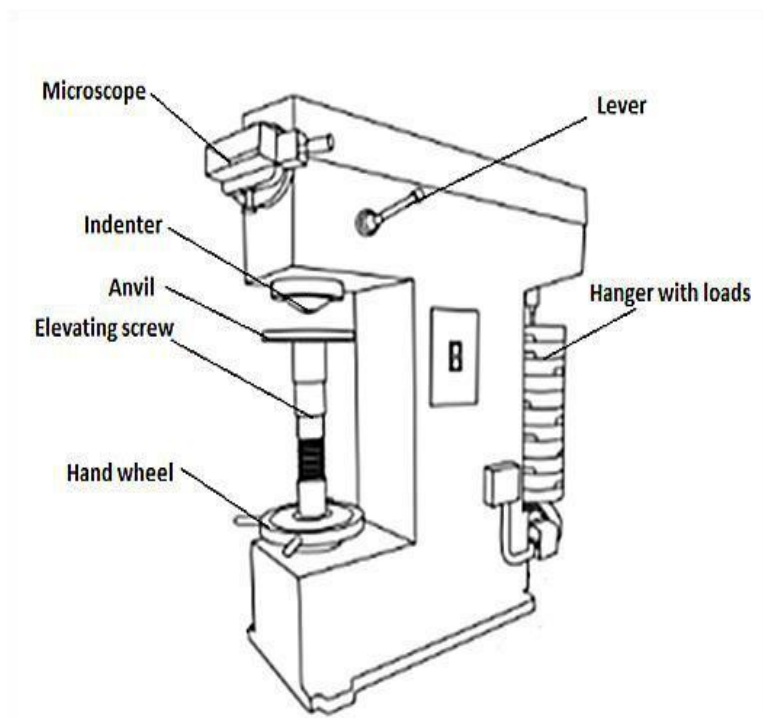


Fig 5.15 Brinell hardness testing machine

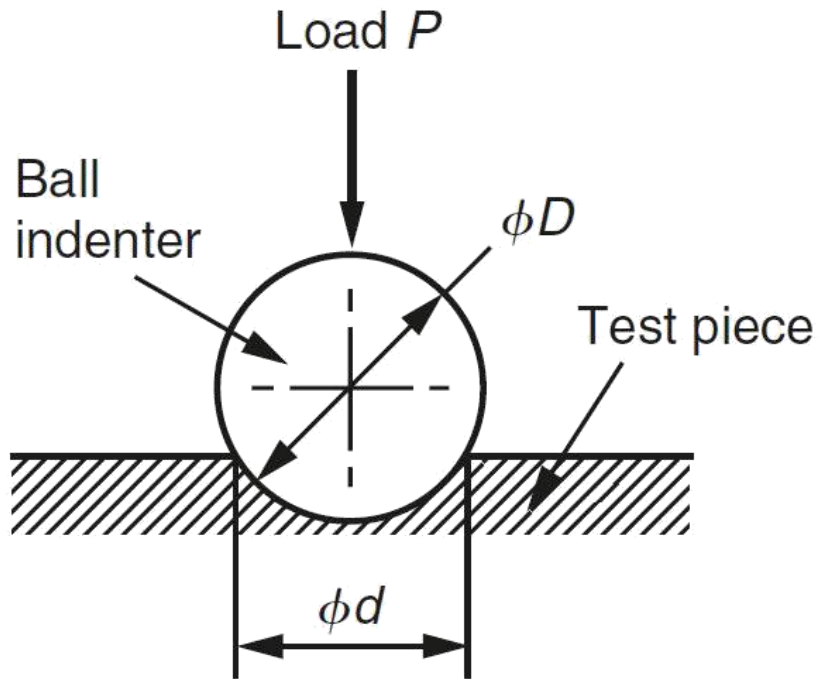


Fig 5.16 Brinell hardness test

Brinell hardness test was introduced by J.A Brinell in 1900. After polishing the surface the specimen is fixed on the plat form of hardness tester.

The test is carried out by pressing a hardened steel or tungsten carbide ball of 10mm diameter on the surface of the work piece.

A load of 3000 kg is applied for hard metals and a load of 500 kg for soft metals. Brinell Hardness number (BHN)

$$BHN = \frac{P}{A} = \frac{P}{\frac{\pi D}{2} (D - \sqrt{D^2 - d^2})}$$

P → Load applied kgf,

D → Diameter of ball, mm

d → Diameter of the Impression, mm

A → Surface area of indentation

Limitations of Brinell test :

Size of impression is large

Not suitable for hard thin pieces

case – hardened parts

Testing metals of low and medium hardness

5.4.2 ROCKWELL HARDNESS TEST :

The principle of Rockwell test differ from that of the others. In that the depth of the impression is related to the hardness rather than the diameter of the diagonal of the impression

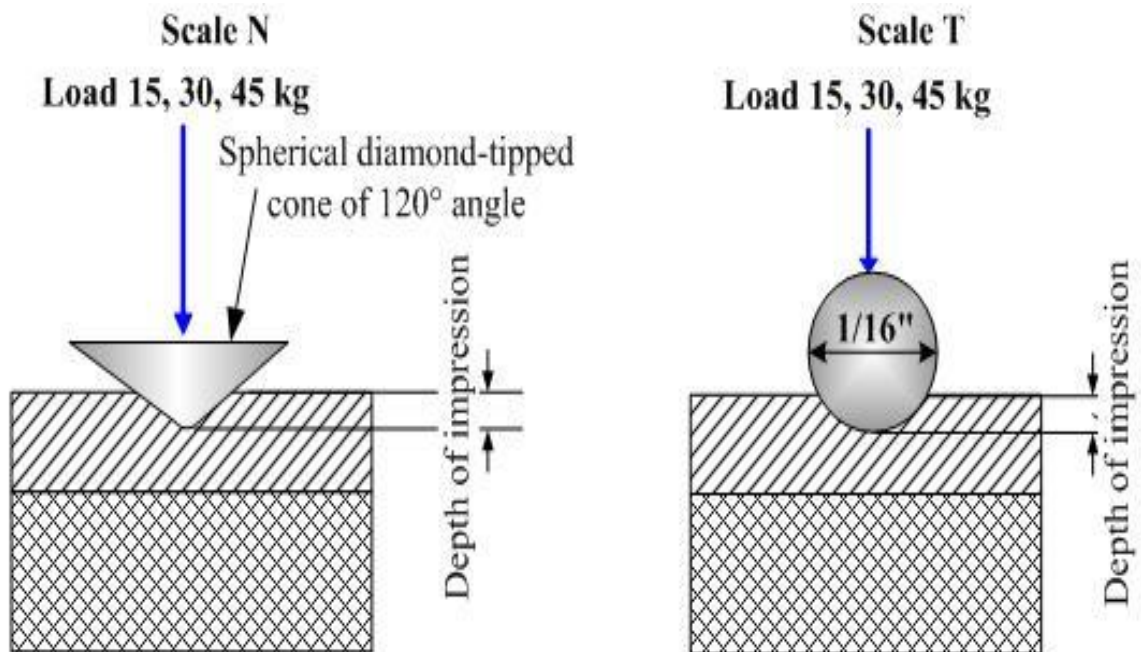


Fig 5.17 Rockwell Indenter

The Rockwell test uses a steel ball or a diamond cone with 120° apex angle. It has a dial with different scales to read hardness numbers directly.

Rockwell B scales directly.

Rockwell C scales used for soft materials

Rockwell C scales used for hard material

It is more flexible

1/16 inch hardened steel ball load t 100 kg

Diamond cone ball load at 150 kg

5.4.3 VICKER HARDNESS TEST :

The vicker hardness is similar to the brinell test with a square based diamond pyramid being used as the indenter.

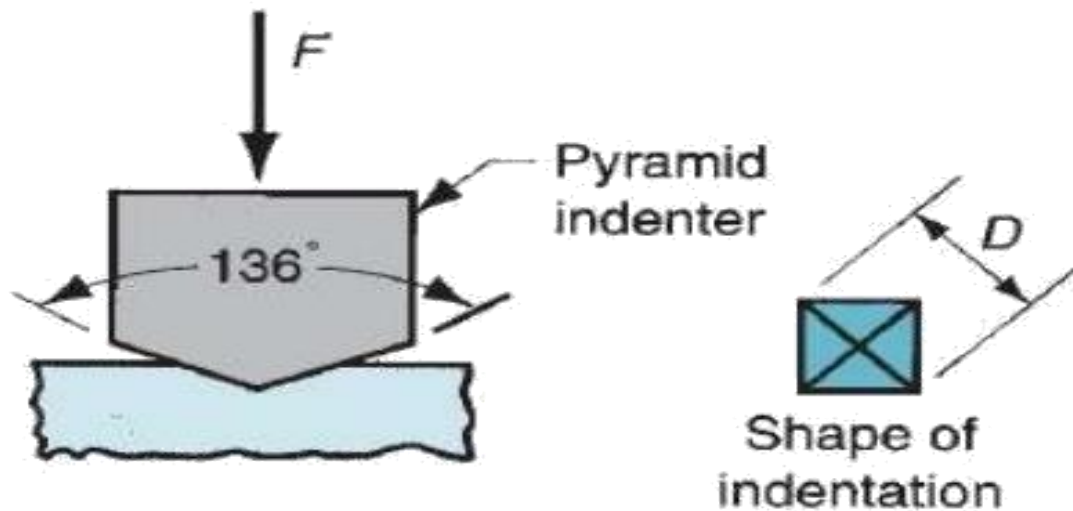


Fig 5.18 Vickers indenter and impression

$$\text{VHN} = \frac{\text{Applied load}}{\text{surface area of impression}} \propto \frac{2P \sin \theta/2}{D^2}$$

$$\text{VHN} = \frac{1.854P}{D^2} \quad \theta = 136^\circ$$

It has an angle of 136° between opposite faces.

It is very suitable for testing polished and hardened materials with greater precision in measurement

It is more expensive than Rockwell and Brinell hardness machines.

Diamond square pyramid load at 30 kg

5.4.4 IMPACT TEST :

Impact test are classified into two types:

Izod Impact test

Charpy Impact test

Impact test is performed to study the behaviour of materials under dynamic load (i.e.) suddenly applied load. The capacity of the material to withstand blows without fracture is known as impact strength or impact resistance. The impact test indicates the toughness of the material, the ability of a material to absorb energy during plastic deformation. Toughness is a measure of both strength and ductility of the material.

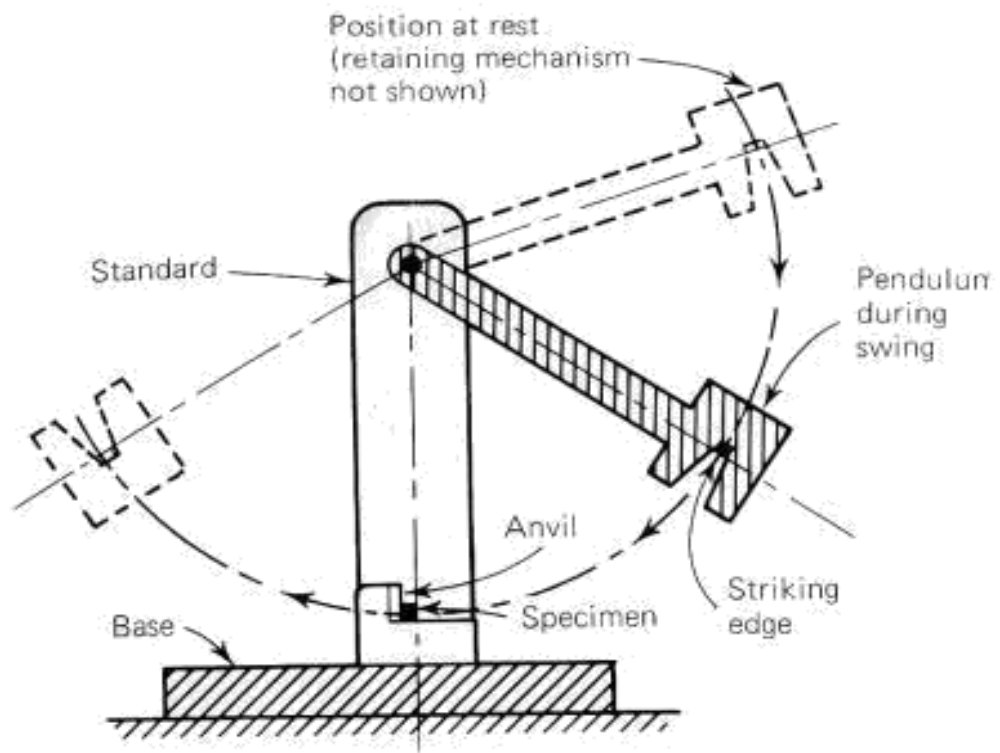


Fig 5.19 Impact Testing Machine

