



NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR
DEPARTMENT OF MECHANICAL ENGINEERING
Solid Mechanics Sessional (ME452)
B. Tech 4th Semester

Experiment: To perform 'Rockwell Hardness Test' experiment

Theory: Rockwell Hardness Test (RHT) measures the hardness of a material. Hardness can be defined as a resistance to penetration. Because of the simplicity, accuracy and extreme versatility of RHT, it is most widely used today than any other type of hardness test. A wide variety of testing conditions is available which permits testing over a wide range of hardness and also permits testing of very thin materials.

In the Rockwell test, in comparison with Brinell test, the hardness numbers do not bear any correlation with the diameter of indentation. Much of the inaccuracy associated with a measurement of total indentation depth is eliminated by the use of differential depth measurement.

The indenter is first seated by a 10 kg '**minor load**', after which a standardized '**major load**' is applied. It is the increment in indentation depth produced by the major load over that produced by the minor load which provides the basis of the Rockwell hardness testing. In this manner, the effects of small surface irregularities and surface disturbances caused by the indentation itself is eliminated, and a very reproducible measurement is made possible.

Rockwell Hardness standard scale are worldwide adopted. An exact of the R.H. scale is given up to D scales.

Rockwell Hardness Scale

Scale symbol	Penetrator	Major load in kg	Rockwell Hardness
A	Sphero-conical diamond	150	RA-X
B	1/6" inch steel ball	100	RB-X
C	Sphero-conical diamond	150	RC-X
D	Sphero-conical diamond	100	RD-X

Apparatus: The Rockwell Hardness machine is a precision-built apparatus which permits an application of accurate, predetermined loads to standardized indenters. It is a device for measuring the depth of indentation produced. The load is applied through a system of weights and levers, and the rate of loading is controlled by a dash-pot mechanism which provides a smooth, steady application of load. A dial gauge indicates indentation depth or the Hardness number directly during the test.

The penetrators which are most frequently used are the sphero-conical diamond penetrator and 1/16" inch steel ball, which are designated as 'C' scale and 'B' scale penetrator, respectively. The 'C' scale penetrator consists of a conical portion with a spherical tip lapped tangent to the cone. The angle of the cone is 120 degrees and radius of the spherical tip is 200 mm.

Procedure:

1. Check the loading lever and make sure that it is in 'off' position. Fix the proper indicator.
2. Place the specimen on the anvil of the machine ready for testing.
3. The anvil is raised slowly by operating the hand wheel until the indenter is contacted, and continued to be raised cautiously until the minor load is applied. This is achieved when the small pointer on the dial points the red dot and the big pointer lines up with the zero.
4. The hardness dial is set to zero on the desired scale. Now, the major load is applied by moving the hand lever forward. The duration of major load application should not be more than 10 seconds.
5. Remove the major load and take the measurement. The members having a deep impression are relatively soft material whereas a high hardness number is indicative of a shallow indentation and thereby a hard material.

Precautions:

- a) Check that the lever for supplying major load is at zero position before applying minor load.
- b) Apply minor and continue so that the pointer does not deflect away from the red mark

Report the following:

1. A net sketch of the Rockwell hardness-testing machine
2. Calculate mean hardness number and indentation depth therefrom.

$$HR = h - 500t$$

Where, h is a constant, 130 for scale B and 100 for scale C, and t is the indentation depth in mm.

Answer the following questions:

- a) What is the difference between Rockwell and Brinell hardness method?
- b) Which one of the two methods is better and well adopted world wise and why?

Results:

Material	Rockwell Hardness Number (HR)	Mean HR	Indentation depth (t) in mm
	1)		
	2)		
	3)		