13/6/2012

EXPERIMENT NO.-4

Object:- To determine Rockwell & Brinell hardness of mild steel cast iron and brass specimen.

Abparatus Used:-
Rockwell Hardness, testing machine, Indentor of diameter of various lengths.

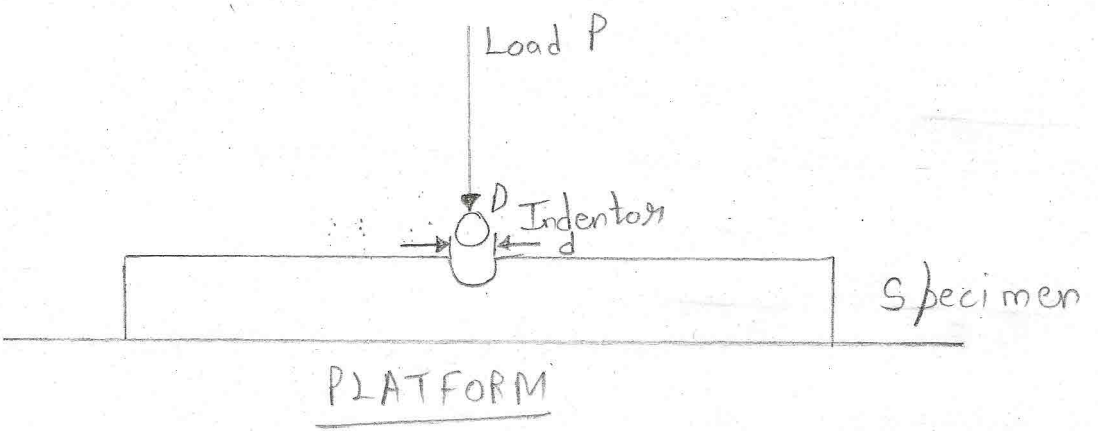
Theory:-
Hardness is defined as a property of material which provides resistance to permanent plastic deformation. Such a deformation may leave a permanent impression on the material surface.

Two types of Hardness

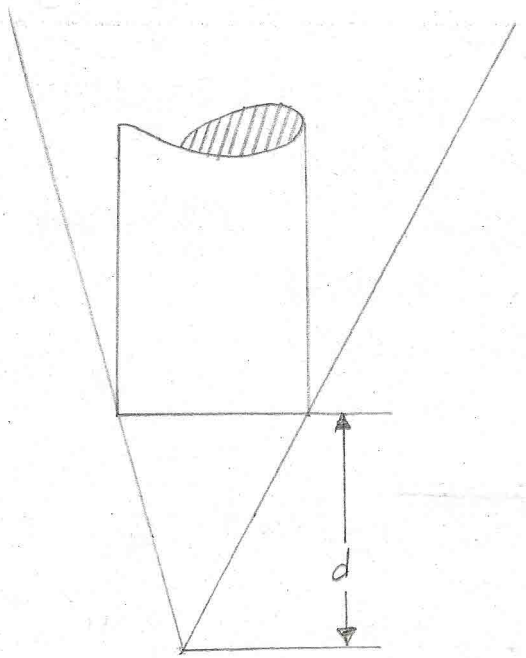
(i) SCRATCH Hardness
(ii) INDENTATION Hardness

1: **Brinell Hardness**

This is a method of indentation hardness & widely applied for technological purposes. This method use a steel ball of 2.5 or 5mm diameter as indentor. A load of about 250 Kg is applied. When the load is removed, an indentation is left upon the surface, the diameter of which is measured by a low



(i) BRINELL HARDNESS



(ii) Depth of indentations, caused by indentor in Rockwell Hardness

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Object: To determine Rockwell and Brinell Hardness of Mild Steel, Cast Iron and Brass specimen.

Apparatus Used: Rockwell & Brinell Hardness Machine

Formula Used: Brinell Hardness Number (BHN) $= \frac{P}{\pi \frac{D}{2}(D - \sqrt{D^2 - d^2})}$

Observations:

Rockwell Hardness Test

Applied Load	Size & Material of Indentor	Rockwell Hardness Value
	MILD STEEL	1- 84
100	1/16" dia Steel Ball	2: 83.5
		3- 82.5
		Average- 83.33
	CAST IRON	
		1- 79
100	2.5mm dia. Steel Ball	2- 81
		3- 83
		Average 81.0
	BRASS	
		1- 66
100	1/16" dia. Steel Ball	2- 66.5
		3: 67
		Average- 66.5

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Applied load(P) (Kg)	Diameter of Indentor(D) (mm)	Diameter of Indentation (d) (mm)	BHN
	MILD STEEL		
200	5	1.4	159.15
	CAST IRON		
187.5	2.5	1.3	130.87
	BRASS		
250	5.0	1.8	97.95

power microscope.

$$B.H.N = \frac{P}{\pi D/2 \left(D - \sqrt{D^2 - d^2}\right)}$$

P → Applied load
D → Diameter of ball
d → Diameter of indentation

2. ROCKWELL Hardness

Rockwell method differs from Brinell method because Rockwell hardness is not measured as ratio of load to indentation surface area. Rockwell hardness is measured on an arbitrary scale on which hardness number is inversely propotional to the depth of indentation.

RESULT:-

Rockwell Hardness value & Brinell hardness

i) Mild Steel = 83.33
ii) Cast Iron = 81.0
iii) Brass = 66.5

i) Mild steel = 159.15
ii) Cast Iron = 130.15

ROCKWELL HARDNESS

Applied load(Kg)	Size of material or indentor	Rockwell Hardness
100	MILD STEEL 1/16th dia. steel ball	1:- 84 2:- 83.5 3:- 82.5 Avg. = 83.33
100	CAST IRON 2.5 mm steel ball	1:- 79 2:- 81 3:- 83 Avg. = 81
100	BRASS 1/16th dia. steel ball	1:- 66 2:- 66.5 3:- 67 Avg. = 66.5

BRINELL HARNESS

Applied load(P) (Kg)	Diameter of Indentor (D) (mm)	Diameter of Indentation (d) (mm)	B.H.N
250	MILD STEEL 5	1.4	159.15
187.5	CAST IRON 2.5	1.3	130.87
250	BRASS 5.0	1.8	94.95

(iii) Brass = 94.95

DISCUSSION ON RESULT:-

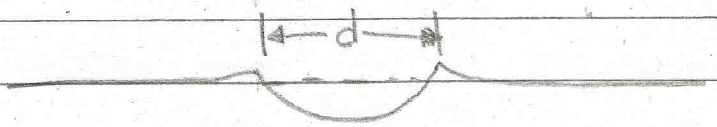
The main focus for acheiving the result is to minimise the percentage error between the true value & the experimental value but this can't be acheived inside a laboratory. The result can be highly accurate but can't be ideal.

Various factors may be, that the zero errors are present in apparatus used.

Errors inside testing machine, while noting it down, etc.

The calculated valve of B.H.N may be slightly wrong because of the assumption that the diameter of indented is same as indentor.

An anamoly can also arise in measurement of diameter of indentation due to localized deformation of metal in the region of indentation, called as piling or ridging.



→ PRECAUTIONS:

1: The load should be applied for a specific time.
2: Care must be taken at the time of measuring the diameter.
3: Thickness of plate must be atleast equal to the diameter of indentor.
4: While making indentation on a plate specimen, care must be exercised to avoid any interference between the indentation & the edge of specimen and the interference between the indentation.

→ ENGINEERING SIGNIFICANCE:-

The property of hardness is related to the binding process b/w atoms & molecules. The hardness increases with the binding forces.

The techniques used for improving the material strength such as heat treatment, mechanical treatment or alloying results in increase in hardness. This can be an easy way to find out the success of any such treatment.

This test is the most widely used for all manufacturing operations so as to measure of uniformity & quality.