

MEEN 335
Materials Processing Laboratory

EXPERIMENT #2
HARDNESS TESTING USING ROCKWELL HARDNESS TEST MACHINES

OBJECTIVE:

- (a) To learn to procedure of the Rockwell Hardness Testing
- (b) To evaluate hardness values for three given steel specimens and
- (c) To relate the hardness results with expected microstructures of given steel specimens

EQUIPMENT USED: Given steel specimens, standard test specimens, and Rockwell Hardness test machines.

REFERENCE MATERIAL: Operating instructions of the test equipment to be used.

PROCEDURE: Prepare two flat surfaces to the given steel specimens to facilitate hardness measurements. Study the operating instructions of the Rockwell hardness test machines and perform a test on the standard test blocks to check accuracy of the Rockwell hardness test machines.

In any test run, make sure that proper weight (major load) and indenter are chosen. Carefully, conduct several test readings on the test surface to obtain an average hardness result. For each specimen record your data in a tabular form.

Provide interpretation of your hardness readings the expected microstructures of the given steel specimens.

ASSIGNMENT:

1. Record hardness values of the standard steel and brass test blocks and calibrate the Rockwell hardness tester for R_B and R_C .
2. Evaluate the hardness of the given engineering alloy specimens.
3. Relate your results with the expected microstructure and material behavior.

DATA SHEET FOR ROCKWELL HARDNESS EXPERIMENT

SAMPLE	HARDNESS READINGS			EXPECTED HARDNESS	EXPECTED MICRISTRUCUTURE
	RA	RB	RC		
TEST BLOCK 1					
	Average				
TEST BLOCK 2					
	Average				
TEST BLOCK 3					
	Average				
AL – CU 2024					
	Average				
BRASS SPECIMEN					
	Average				
STEEL SPECIMEN					
	Average				
STEEL (ANNEALED)					
	Average				
STEEL (QUENCHED)					
	Average				

BEFORE STARTING TEST SEE THAT CRANK HANDLE (1) IS PULLED FORWARD COUNTER-CLOCKWISE AS FAR AS IT WILL GO. THIS LIFTS THE POWER ARM AND THE WEIGHTS.

1. Select proper penetrator (2) and insert in the plunger rod.
2. Place proper anvil (3) on elevating screw.
3. Place specimen or test block on the anvil.
4. Raise specimen into contact with the penetrator by turning capstan handwheel (4) clockwise. Continue motion until small pointer (5) is near the dot. Continue until the large pointer (6) is in a vertical position.
5. Turn the bezel of the dial gauge, thru the opening in the cowl below the dial gauge, until the "SET" line is directly behind the large pointer.
6. Release the weights (MAJOR LOAD) by tripping the crank handle rearward. **DO NOT FORCE THIS CRANK HANDLE. ALLOW THE DASH-POT TO CONTROL THE SPEED OF TEST.**
7. When the large pointer comes to rest return the crank handle to the starting position. This removes the MAJOR LOAD. The MINOR LOAD is still applied.
8. Read the scale letter and "ROCKWELL" number from the dial gauge.
9. Remove the MINOR LOAD by turning the capstan handwheel (4) counter-clockwise to lower the elevating screw and specimen so they clear the penetrator.
10. Remove the specimen or repeat the test.

CAUTIONS TO BE TAKEN WHEN MAKING ANY "ROCKWELL" HARDNESS TEST.

PENETRATOR. Be sure the mating surfaces of the penetrator and the plunger rod are clean and free of dirt, chips and oil; these prevent proper seating and cause a false "ROCKWELL" hardness test. After changing any penetrator or putting a new ball in a ball chuck, or changing the anvil, several tests should be made to seat these parts before any hardness readings are taken.

ANVILS. Be sure the mating faces of the anvil and the end of the elevating screw are clean and free of dirt, chips and oil. These prevent good seating and cause a false "ROCKWELL" hardness test. If the shape of the part is so irregular that it cannot be solidly supported on any of the standard anvils without shifting under application of the MAJOR LOAD, then a special anvil or method of support must be devised.

SPECIMEN. Be very careful of the placement of the test specimen on the anvil so it is solidly supported. Any loose scale, coarse tool marks, nicks or burrs which might make contact with the anvil will cause a false test by collapsing under the MAJOR LOAD and thus allow the work to move.

Loosing or flaking scale where the penetrator makes contact with the specimen may chip away and cause a false test. This must be filed or ground away. Decarburize surface metal must be filed away to permit the penetrator to start the test in the good metal.

ROCKWELL HARDNESS NUMBERS

There are no “ROCKWELL” values shown by numbers alone. Each “ROCKWELL” hardness number is a scale letter and number, for example C 60. The letter “C” indicates a load of 150 kg. and the diamond “BRALE” penetrator. The number 60 is read from the black scale of the NORMAL “ROCKWELL’ dial gauge.

SCALES – NORMAL TESTER

Scale Symbol	Penetrator	Load in Kilograms	Figures
B	1/16” ball	100 kg.	Red
C	“BRALE”	150 kg.	Black
A	“BRALE”	60 kg.	Black
D	“BRALE”	100 kg.	Black
E	1/8” ball	100 kg.	Red
F	1/16” ball	60 kg.	Red
G	1/16” ball	150 kg.	Red
H	1/8” ball	60 kg.	Red
K	1/8” ball	150 kg.	Red
L	1/4” ball	60 kg.	Red
M	1/4” ball	100 kg.	Red
P	1/4” ball	150 kg.	Red
R	1/2” ball	60 kg.	Red
S	1/2” ball	100 kg.	Red
V	1/2” ball	150 kg.	Red

SCALES – SUPERFICIAL TESTER

Scale Symbol	Penetrator	Load in Kilograms
15N	“BRALE”	15 kg.
30N	“BRALE”	30 kg.
45N	“BRALE”	45 kg.
15T	1/16” ball	15 kg.
30T	1/16” ball	30 kg.
45T	1/16” ball	45 kg.
15W	1/8” ball	15 kg.
30W	1/8” ball	30 kg.
45W		
15X	¼” ball	15 kg.
30X	¼” ball	30 kg.
45X	¼” ball	45 kg.
15Y	½” ball	15 kg.
30Y	½ “ ball	30 kg.
45Y	½” ball	45 kg.