Graph of (w/v) Scale x axis 1/2

EXPERIMENT ONE

TITLE IMPACT TEST Y axis

Objective To investigate the impact strength of a certain material when subjected to pendulum impact test

Abstract

The lab report entails the detailed procedure, results and discussion on the impact strength of a material. The test is by breaking by the blow from a swinging pendulum, under standard conditions, a piece of metal notched on one side. The specimen is used and to calculate the blow the energy absorbed is the measure of impact strength of the material

Introduction

Understanding when and how engineering materials fail is the fundamentals to engineering. Engineers solve human's technological problems thereby. Studying the fracture point and the energy a certain material can absorb is in order to use them for engineering purposes. Metals, ceramics and polymers are mostly used to know the energy this material can absorb before deforming or the force they can withstand. Below are definations related to impact test.

- Impact test:- this is a technique for determining the behaviour of a material when subjected to an external force
- Strength:- it is the ability of a material to resist deformation
- Hardness - this is a property of a material to be rigid and resistant to pressure and scratch
- toughness - ability of a material to absorb considerable energy before cracking.

Graph of 6/10 Scale x axis 4/5

Y axis

EXPERIMENT ONE

TITLE: IMPACT TEST

Objective: To investigate the impact strength of a certain material when subjected to pendulum impact test

Abstract:

the lab report entails the detailed procedure, results and discussion on the impact strength of a material. the test consist of breaking by one blow from a swinging pendulum, under standard conditions whereby a piece of metal notched at the middle and supported, at each end to recieve the blow the energy absorbed is the measure of Impact Strength of the material.

Introduction:

Understanding when and how engineering materials fail is the fundamental to engineering. Engineers solve human's technological problems thereby studying the fracture point and the energy a certain material can absorb in order to use them for engineering works, design, and other purpose, we need to know the energy this material can absorb before deforming and the force they can withstand. Below are definations related to impact test.

Metals, ceramics and polymers are mostly used

- Impact test:- this is a technique for determining the behaviour of a material when subjected to an external force.
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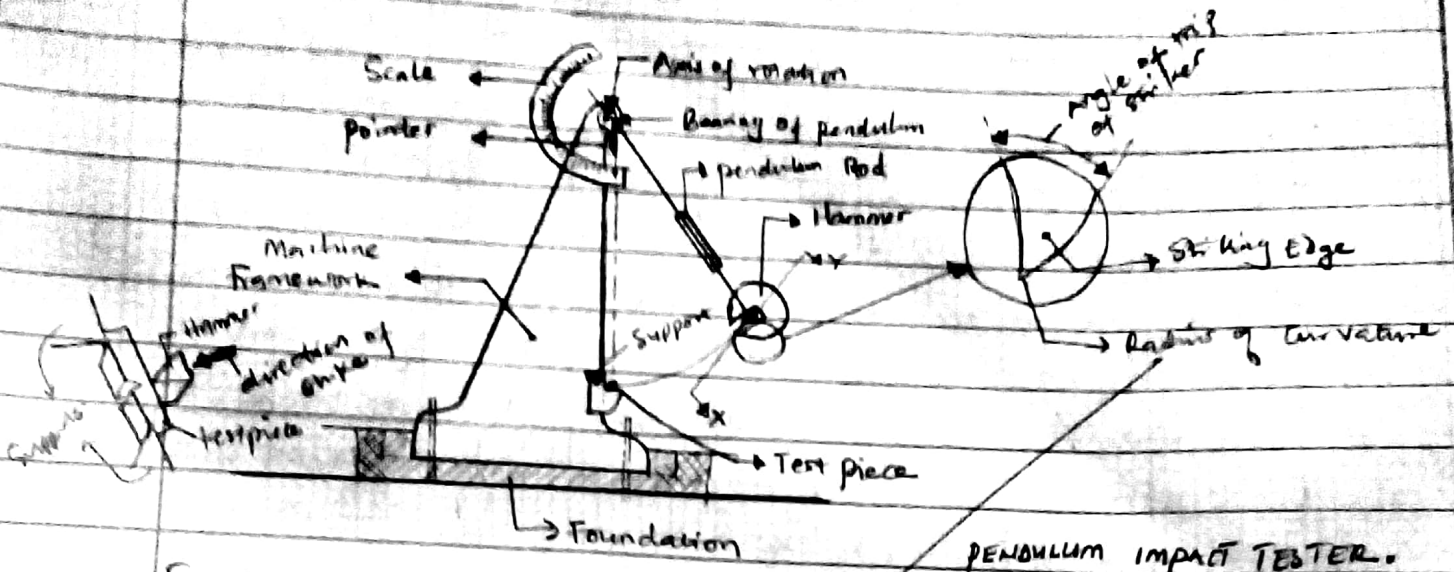
WAEC STANDARD GRAPH

Graph of

Scale x axis

Y axis

MACHINE SKETCH DIAGRAM



PENDULUM IMPACT TESTER.

Source: me.aut.ac.ir/staff/Saiid mechanics/alijadeh/impact%20test_files/image003

METHODS & materials:

There are two methods of aligning the Simple used for this experiment which are

(1) IZOD:- In this method the test material to be placed in a Vertical position the point at which the hammer Strike is at the upper tip of the specimen and the notch face is facing the Striker. the ~~same~~ method was named after the former Edwin Gilbert IZOD.

(2) Charpy :- In this method the test material are placed horizontally and the test hammer Strikes the point of notch but in opposite direction i.e the notch face is positioned away from the Striker. Here there are two types of notch used, these are the U-notch and the V-notch.

In this experiment the material to be tested is a metal and the charpy method is used.

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Y axis

APPARATUS:

The Impact testing unit has a swinging hammer arm that is connected to a shaft located in the top of the pillar the length of the arm corresponds to the weight of the test sample which is placed on the anvil and inside the bottom of the pillar and the anvil are precisely positioned into a heavy base to align the sample with the Impact tip when it swung arround the axis. Inside the pillar there are a set of bearings these allows the shaft to rotate freely with little resistance. The protractor cover sits in front of the shaft and it is supported by the stopper block. The protractor cover holds the plunger activators in place at thier set heights as well as accomodating the pointer when the hammer is released and allow to drop, there is a pin on the hammer arm which engages with a pin at a rear of the pointer this pushes it and makes it rise with the arm after the Impact tip has collided with the specimen.

When the arm falls back the pointer stays in its highest position from this a reading can be taken of how much energy has been absorbed by the test specimen itself sit inside the pillar and in a seat of the anvil when broken any debris from the experiment will be contained within the protective cover

PROCEDURE:

the front panel of the protective cover was removed and the apparatus was inspected to be free of debris from previous experiments the hammer head was set up to a required weights and also the

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Y axis

The weight was noted. The specimen cross-sectional area was also noted. The specimen was then inserted carefully aligned to the notch on impact plates.

The pointer was set at 0° position when the hammer was at its equilibrium position.

the hammer was moved to a height (h_1) and the height was recorded.

the plungers were engaged and the hammer rested at the height (h_1) the protective ~~tape~~ cover was replaced back for safety. the four knobs was loosed for it to make way for the hammer. while it rest on the last plunger.

One hand was rested against the "push block" through the acrylic casing then the plunger activator that the hammer was resting on was released and it falls freely and strike the specimen at the bottom of the swing.

the test specimen was broken and the angle of rise has reach its peak. the angle that the pointer shows was recorded and the experiment was repeated three 3 times.

RESULT

Test specimen	Cross sectional Area (mm)	Start height (h_1)(m)	Start angle $\alpha°$	finish Angle $\beta°$
material unknown	8 by 3	0.4863	132.31	113.32

mass of hammer = 4kg pendulum arm R = 345mm

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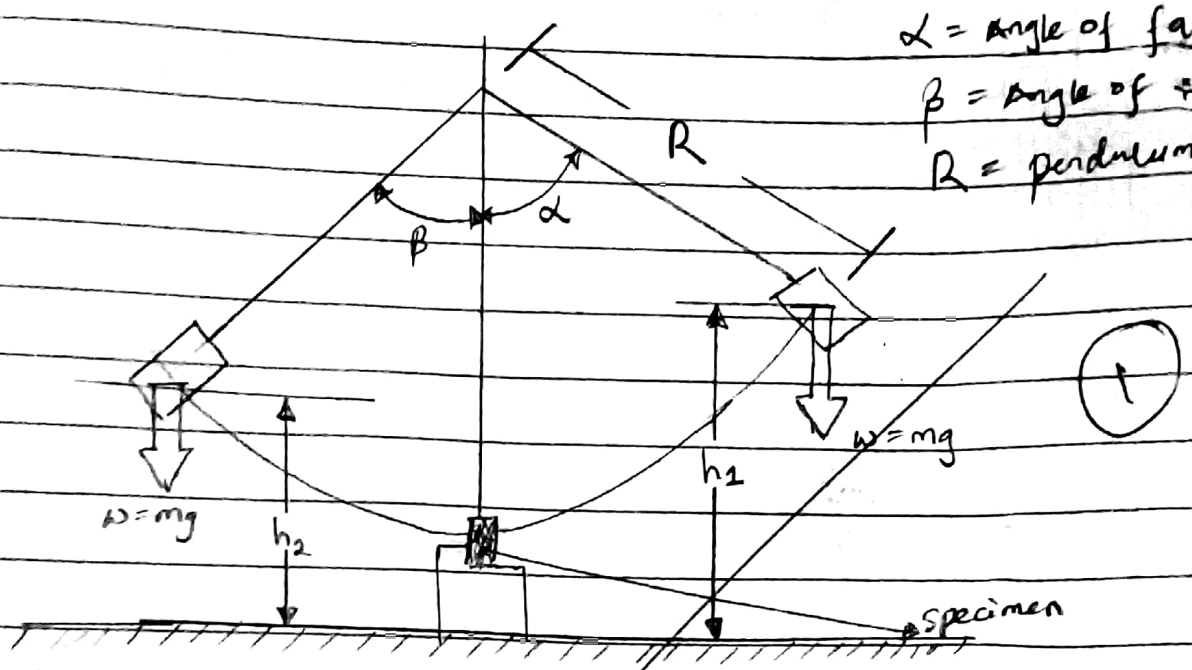
Graph of

Scale x axis

Y axis

EXPERIMENTAL SETUP OF AN IMPACT TESTER.



CALCULATIONS

Given Data's:

$m = 4kg$ $g = 9.81 m/s^2$ $R = 345mm = 0.345m$

$\alpha = 148.87^\circ$

$\beta = 107.72^\circ$

$h_1 = 0.6388m$ $h_2 = ?$

CSA = $L = 10.5mm = 0.0105M$

$B = 6.6mm = 6.6 \times 10^{-3}m$

Find

(a) $E_p = ?$

(b) $A_K = ?$

(c) aks

(d) Compare between the two aks:

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Graph of

Scale x axis

Y axis

(a) $E_p = m \times g \times h_1$

$= 4 \times 9.81 \times 0.6388$

$E_p = 25.7\,J$ → potential Energy

(b) $(h_1 - h_2) = R(\cos\beta^\circ - \cos\alpha^\circ)$

$-h_2 = R(\cos\beta^\circ - \cos\alpha^\circ) - h_1$

$-h_2 = 0.345(\cos 107.72 - \cos 148.87) - 0.6388$

$= 0.345(0.350) - 0.6388$

$= 0.19044 - 0.6388$

$-h_2 = -0.44836$

$h_2 = 0.44836m$

$A_k = mg(h_1 - h_2)$

$= 4 \times 9.81(0.6388 - 0.44835)$

$= 89.24(0.19045)$

$A_k = 7.47\,J$ → the amount of energy absorbed

(c) $q_k = \dfrac{A_k}{CSA}$ $\quad CSA = L \times B = 0.0705 \times 6.6 \times 10^{-3}$

$CSA = 6.93 \times 10^{-5} m^2$

$q_k = \dfrac{7.47}{6.93 \times 10^{-5}}$

$= 107792.21\,J/m^2$

$= 107.79\,kJ/m^2$ → the notched bar Impact Strength.

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Y axis

DISCUSSION

- From the result obtained after the experiment the initial energy is 05.1J , 7.47J of energy was absorbed by the test specimen giving it a notched bar impact of 107.79 kJ/m²

- Sources of Error:
  1. Air resistance
  2. Faulty apparatus in the setup
  3. parallax error while taking Reading.

- precautions:
  1. measurement are taken precisely and accurately before taking the average as the result obtained.
  2. the experiment was carried out in a less ventilated space to avoid the Air resistance.
  3. For safety purpose, the front panel protective cover was replaced before releasing the hammer.

- Conclusion:
  The aim of the experiment have been achieved because we learnt the knowledge behind the impact test which is to determine the strength of materials.

- References.
  1. material science for engineers by William D callister
  2. Bayero university Lab manual for tech 2204
  3. Wikipedia and google

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HARDNESS TESTING

Y axis

Aim: To Study the Rockwell Hardness testing machine and perform the Rockwell hardness test.

Abstract:

With the advancement in materials and the interest in Strength and ability there has been a several testing machine methods in this experiment the Rockwell testing machine was used to determine the hardness of certain metals. Also the experiment is concerned with understanding the basic principle of hardness measurment using the Rockwell machine

Introduction:

Hardness Represent the resistance of material Surface to abrasion Scratching and cutting, hardness after gives clear indication of strength. In this hardness test a define force is mechanically applied on the piece, Varies in Size and shape for different test. Common indenters are made up of hardned steel or diamond.

there are Several reasons that make hardness test be performed more frequently than other mechanical test which are

① they are Simple and inexpensive

② the test is non destructive

Identation can be defined as the method of exposing a material to a small deformation Such as Scratching

WAEC STANDARD GRAPH

Graph of

Scale x axis

Y axis

METHODS / materials

There are several methods employed for determining the hardness of a material such as Vicker test, Brinell test and Rockwell test. In this experiment the rockwell was used to determine the hardness of material (Specimen) Rockwell hardness tester present directly reading of hardness number on a dial provided with the machine.

Various Scale of Rockwell hardness test are

Scale	type of Indenter Used.	Initial load In Kgf	Major load	Kind of material
A HRA	Cone 120° diamond	10	50	much harder material such as steel
B HRB	Steel sphere Ball · 7.58mm 1/6 inch diameter	10	90	Soft steels, Copper Aluminium, Brass Grey Cast Iron.
C HRC	Cone 120° diamond	10	140	Hard steels eg Tungsten, titanium etc

PROCEDURE:

The diamond Cone indenter was inserted in its holder. The Specimen surface was clean by remove dust, dirt and oil and grease etc. the scale was set at a zero and Coincide

WAEC STANDARD GRAPH

Graph of

Scale x axis

Y axis

with the Vernier Scale. The Specimen was now put on the Anvil & Contact between the Surface of the Specimen and the ball was made by rotating the Jack adjusting wheel the required button knob for loading (Set at HRC). The load release lever was pulled slowly and wait for a minimum of 16sec until the Scale stop deflecting. the load lever was then released and the Scale reached been recorded. the process was repeated 3 times for each material and the average result was obtained and recorded.

Result

S/N	Sample	Hardness
1	Aluminium	14 HRC
2	Cast Iron	60 HRC
3	Metal rod	54 HRC
4	Mated Steel	44 HRC
5	Mild treated low carbon steel	64 HRC

Indenter: Diamond Cone Identeater.

Scale: C

Discussion

In this experiment the hardness of materials was tested using Rockwell machine. the Rockwell hardness test

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Graph of

Scale x axis

Y axis

is a hardness measurement based on the increase in depth of impression as load is applied.

the experiment was not time consuming and the specimen undergoes a little a negligible deformation. It is advisable of Engineers to use the machine each an everytime there is need for that.

But from the defination of hardness the rockwell machine can be seen as a useful apparatus used to measure relative resistance to deformation but it does not serve well as a predictor of other properties such as strength or resistance to scratches, abraission or wear and should not be used alone for product design.

Sources of Error.

1. Dirty or oilly specimen
2. Error due to parallax
3. Applying much force to load release lever contribute to error.

precaution

1. looking from the scale from angles was avoided
2. the load release lever was adjusted carefully and slowly.
3. the identer used was not blunt.
4. the scale pointer has stopped before readings were taken.
5. the specimen was free from dirt.
6. the Rockwell machine was in good working condition.

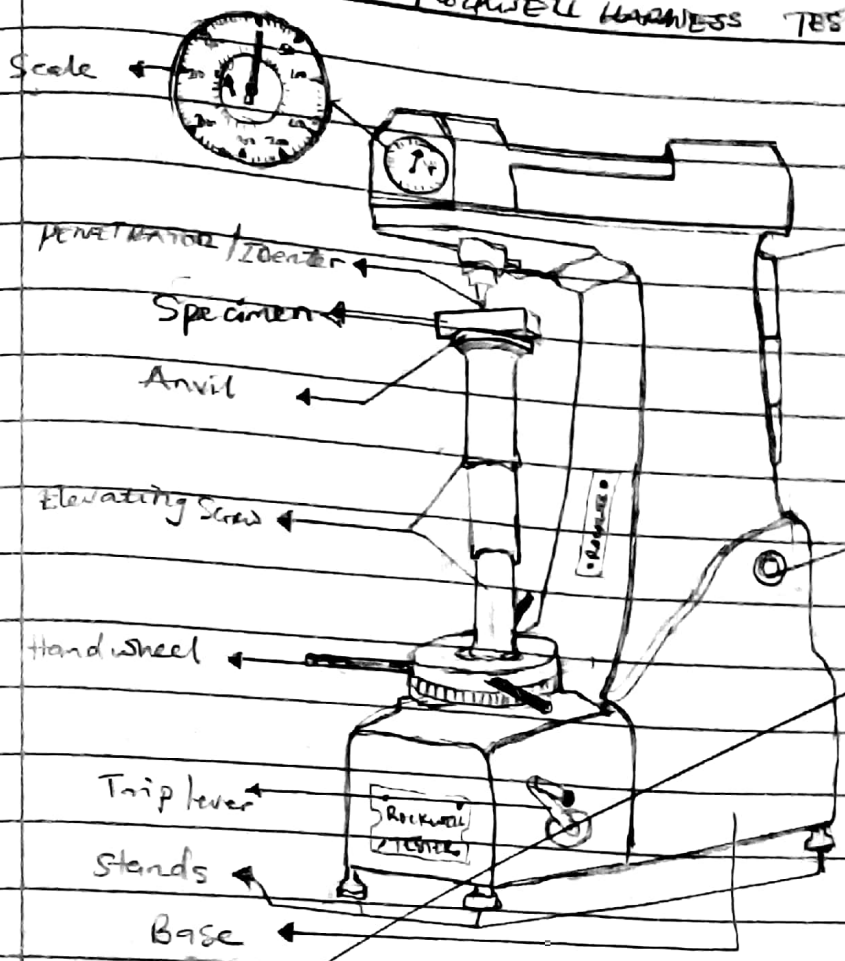
WAEC STANDARD GRAPH

Graph of

Scale x axis

Y axis

DIAGRAM OF THE ROCKWELL HARDNESS TESTING MACHINE



Source;
www.tpub.com/air/jpg/1-36-7.jpg

ROCKWELL MACHINE LABELLED.

Conclusion

the experiment illustrate that the rockwell machine can be used to measure some property of a material. The knowledge behind the Rockwell testing machine was achieved. The hardness of some metals were noted.

References:

(1) Bayero university Kano lab manual for tech 220 by Mr Bichi

(2) Google

WAEC STANDARD GRAPH

Y axis

INTRODUCTIONS TO BRINELL HARDNESS TESTING MACHINE

DR. J.A Brinell invented the brinell test in Sweden in 1900 the oldest of the testing method in common use today the brinell test is frequently used to determine the hardness of forging and castings that have a grain structure - the Brinell test are frequently done on the large parts by varying the test force and ball size nearly all metals can be tested using a Brinell test. Brinell values are considered test force ~~independent~~ independent as long as the ball and force/test force relationship is the same.

Brinell testing is typically done on iron and steel casting using a 3000kg test force and a 10mm diameter carbide ball. Aluminum and other softer alloys are frequently tested using a 500kg test force and a 10mm diameter carbide ball.

Therefore the typical range of Brinell Testing is 500 to 3000kg with 10mm carbide balls.

Brinell test Method.

All brinell tests use a carbide ball indenter. the test procedure is as follows

1. the ~~face~~ indenter is pressed into the sample by an accurately controlled test force.
2. the force is maintained for a specific time normally 10 - 15 seconds.

Scale x axis

Y axis

(3) after the time is reached the border is removed leaving a round indent in the sample.

(4) the size of the indent is determined optically by measuring two diagonals of the round indent using either a portable microscope or one that is integrated with the load application device.

(5) the Brinell hardness number is a function of the test force divided by the curved surface area of the indent. the indentation is considered to be spherical with a radius equal to the half of the diameter of the ball the average of the two diagonals is used in the formular to calculate the brinell hardness

$$HB = \frac{2F}{\pi D\left(D - \sqrt{D^2 - d^2}\right)}$$

where

F = mass in kg

D = diameter of the ball

The Brinell number which normally ranges from HB50 to HB750 for metals will increase as the sample gets harder. the result obtained is written in the format "256 HBW" wher 256 is the calculated hardness and "W" indicates that a carbide ball was used previous standards allowed a steel ball and had and S designation steel balls are no longer allowed or used

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Y axis

VICKERS TESTING HARDNESS MACHINE

The Vickers hardness test was developed in 1921 by Robert L. Smith and George E Sandland at Vickers Ltd. as an alternative to Brinell's method to measure the hardness of materials. The Vickers test is often easier to use than other hardness test since the required calculations are independent of the size of the indenter and the indenter can be used for all materials irrespective of hardness. The basic principle as with all common measure of hardness is to observe the quantitative material ability to resist plastic deformation from a standard source. the Vickers that can be used for all metals and has one of the widest scales among hardness test the unit of hardness is given by the test is known as the Vickers pyramid number (HV) or diamond pyramid hardness (DPH) the hardness number is determine by the load over a surface area of indentation and not the area normal to the force and therefore not pressure the area can be determined by the formular

$$A = \frac{d^2}{2\sin(136°/2)} \Rightarrow A \approx \frac{d^2}{1.8544}$$

where d = average length of the diagonal left by the indenter

WAEC STANDARD GRAPH

Graph of

Scale x axis

Y axis

$$HV = \frac{F}{A} \approx \frac{1.8544F}{d^2} \ (kgf/mm^2)$$

Where,

F is in (kgf) and d is in (mm)

Vickers hardness number are expressed as 440 HV30 where

- 440 is the hardness number
- HV gives the hardness scale (Vickers)
- 30 indicates the load used in kgf

Differences between Brinell, Rockwell and Vickers hardness test

Rockwell	Brinell	Vickers
(1) It is based on difference of indentation depth of indenter from the offset load application	Hard ball indenter is pressed under load on surface of the material it is therefore set dwell time to achieve equilib	(1) Vickers square base pyramid diamond indenter is pressed under load.
(2) Conical diamond indenter with 120° included angle. Ball indenter 1/16, 1/8, 1/4 and 1/2 inches diameter	Ball indenter of 1mm 2.5mm 5mm and 10mm ball diameter	Vickers square based pyramid diamond.

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Graph of

Scale x axis

Y axis

(3) it depends on the load applied to it	Brinell hardness values vary for applied load.	Vickers hardness values are independent of load applied
(4) penetrator method is deep	penetrate method is diamond	penetrate method is width
(5) two basic ranges kgf range 0 - 100 - 1000 kgf	load ranges from 500 - 3000 kgf	load range is 5-120kgf

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