

Hardness testing and elastic plastic deformation of cantilever beam essay sample



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This experiment examined the effect of a load placed on the end of a cantilever beam as well as the hardness of three different metals using the QV-700 Universal Hardness Tester.

Introduction

The overall purpose of this experiment is to become more familiar with experimental processes which will be used continuously throughout the semester. The first process was indentation hardness testing. This was done to find the plastic deformation of three different materials using a QV-700 Universal Hardness Tester. The second process was bend beam testing. This test was performed to determine and compare the Modulus of Elasticity, Yield Strength and Yield Strain on four different materials using a cantilever beam and vernier calipers. Background

-Plastic Deformation-

When a material is permanently deformed after a force is applied then removed. -Modulus of Elasticity-

Describes the materials properties to be deformed elastically/non-permanently. This is the slope of the stress-strain curve in the elastic region.

-Yield Strength-

The level of stress at which material begins to permanently deform.

Equipment

-QV-700-

Uses the Rockwell mode and for this particular experiment used a diamond 120 degree cone-shaped Brale indenter. User can select from a limited range of forces to be applied on material due to using a Brale indenter. After a

force is applied, the indentation size is measured, which indicates that particular material's plastic deformation.

Methods and Materials

QV-700 Universal Hardness Tester

110 Copper Rods

6061-T6 Aluminum Rods

1018 Steel Rods

Fiberglass Rod

Assorted Metal Balls (2. 04g & 8. 33g)

Plastic Cup

Ruler

Calipers

Clamp

String

Experimental Procedure

Each rod was tested the same way on the cantilever setup. First the Fiberglass rod was placed in the cantilever device and was tightened down securely. A nut connected to a string that attached to the cup was placed on the end of the cantilever beam. The calipers were placed on the top of the end of the cantilever beam so it was just barely touching and then they were zeroed. Two at a time, the small balls were gently placed into the cup and the deflection was measured by moving the calipers down so that they once again barely touched the rod. The deflection was observed and written down.

Two more balls were placed in the cup and the deflection was measured

again. This process continued until there were twenty small balls in the cup
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and we obtained ten deflection readings. This was the end of the elastic testing for the fiberglass.

The small balls were removed from the cup and the caliper was once again zeroed at the top end of the fiberglass cantilever beam. Now the plastic portion of the testing was to begin. The cup was held in the hands of a tester as four large balls were added. Then the tester let the cup hang from the cantilever beam for five seconds. After the five seconds were up, the tester gently raised the cup so the cantilever no longer supported it. The spot where the caliper touched the cantilever was then examined to see if there was any permanent deflection in the rod. If there was a small gap where the two once touched the experiment was over and the balls were counted. If they were still touching, four more balls were added and hung in the same manner as before. The procedure continued until permanent deformation was seen and the calipers and cantilever no longer touched after being unloaded. The elastic and plastic testing were repeated in the same fashion for the other three metals

Lastly the three metals were tested on the QV-700 Universal Hardness Tester. Fiberglass was not hard enough to be tested using this machine. Small one-inch rods of the metals were encased in a polymer and were grinded down to create a flat surface on both sides. This allowed for quick testing along with accurate results. The copper rods were tested first by placing them on the hardness tester and lining the tip up with the center of one of the rods. The middle dial was zeroed and then the large bottom wheel was used to gently push the tip into the copper. Once the reading was close to 100 the bottom lever was left alone and the dial was used to precisely line <https://assignbuster.com/hardness-testing-and-elasticplastic-deformation-of-cantilever-beam-essay-sample/>

up the hardness tester with the starting line. Then the upper right lever was slowly pushed back until it stopped. The reading settled for ten seconds and then the upper right level was pulled forward to obtain the hardness number. This same process was repeated again for a different copper rod. The other two metals were tested in the same manner to acquire two hardness numbers for each.