CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Sina S. Astani

Project Number
J1801

Project Title
The Determination of Elastic Modulus with Linear Relationship of Stress vs. Strain

Abstract

Objectives/Goals
The objectives of this project were to determine the Elastic Modulus (Young's Modulus) of materials, which is the stress (force/area) divided by the strain (change in length/ initial length) of materials, and to prove that the stress has a linear relationship with the strain of materials.

Methods/Materials
A mechanism was built that would find the change in length of a material when a given force was applied. These three lines were the materials that were tested: kevlar, copolymer (nylon and other polymers), and copper. Before the testing process had actually begun, the three lines were tied to swivels and then were attached to the mechanism. Then the dial scale was placed beneath the weight platform. The testing process began when five different forces were applied to each line and then the change in length was shown on the dial scale.

Results
The Elastic Modulus of the kevlar had ranged from about 44 Gpa to about 49 Gpa and averaged about 46 Gpa. Kevlar's stress vs. strain graph had been clearly the most linear out of all the graphs. Copolymer's Elastic Modulus went from about 1 Gpa to about 2 Gpa and averaged about 2 Gpa. Its graph was relatively linear but had a sudden upward curve near the end. Copper's Elastic Modulus went from about 24 Gpa to about 38 Gpa and averaged about 30 Gpa. This material's graph was the least linear and had a few upward and downward curves.

Conclusions/Discussion
This project generaly determined Young's Modulus and proved the linear relationship between stress and strain in elastic deformation of materials. In addition it gave me a better understanding of the fundamentals and basics of properties of materials and their strengths. This also gave me knowledge about material behavior when a load is applied.

Summary Statement
The project I had conducted was about the relationship of stress and strain of materials.

Help Received
Father helped me build mechanism. Uncle helped me test materials. Cousin took pictures. Stepfather helped me get materials.