



**CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY**

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Project Title
Which Type of 3D Printed Plastic Is the Strongest?

Abstract

Objectives/Goals
The objective of this experiment is to find out which 3D printed plastic is the strongest given the variety of plastics available. This is a home designed experiment that focuses on the Tensile Strength of 3D printable materials, leveraging from ASTMs D638 Standard Test Method for Tensile Properties of Plastics. 3D printing has become more available and affordable in the consumer market. It would be advantageous for home users to know which 3D printed plastic is the strongest, so they can use it when printing objects.

Methods/Materials
To conduct this experiment, the Test Equipment had to be first designed and fabricated. The Test Equipment consists of a Frame Assembly, digital hanging scale, Test Block Assembly, Drive Mechanism, and a drill. Ten Test Specimens of each plastic filament (PLA, Polywood, ABS, HIPS, and PET) were 3D printed, for a total of fifty samples. The Test Specimen was then incorporated into the Test Block Assembly and hooked up between the scale and the Drive Mechanism. During each test run, a drill was used to turn the Drive Mechanism and pull each Test Specimen apart, while a video camera recorded the scale display. Load values were extracted from the video and used to calculate the Tensile Strength of each Test Specimen.

Results
PLA had the highest Average Tensile Strength of 6.9 ksi while PET came in second with 5.3 ksi. Polywood, ABS, and HIPS followed with 3.7 ksi, 3.5 ksi, and 2.8 ksi, respectively. PLA had the highest Average Load of 82 lbs. before the samples broke. PET followed closely behind at 80 lbs. Polywood, ABS and HIPS had significantly lower Average Loads at Break.

Conclusions/Discussion
The data collected did not support the hypothesis that PET is the strongest 3D printed plastic. PLA was the strongest 3D printed plastic given that it had the highest Average Tensile Strength. This project recommends that home users use PLA filament when printing models that require high Tensile Strength.

Summary Statement
Tensile Strength testing of various 3D Printed Plastics to determine which material is the strongest, using a home designed test set up.

Help Received
My father taught me how to use the 3D Printer and showed me how to use the power tools to build the Test Equipment.