CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Ryan M. Beam

Project Number

S1801

Project Title

Testing How Infill Affects the Conductivity of 3D Printed Heat Shields

Abstract

Objectives/Goals

The objective is to determine how the density of an object (in this case, a 3D Printed "heat shield") affects the rate at which heat travels through it.

Methods/Materials

24 3D printed heat shields (designed in Solidworks, made with printrbot simple metal 3D printer), 3 of each infill/density ranging from 0-70% solid, increasing in 10% increments. Arduino and Thermocouple for measurement of heat. Heat gun to provide consistent temperature levels. Computer with serial monitor to observe results. Timed how long it took for the back of each shield to reach 85 degrees fahrenheit, starting at room temperature, when the front of each was subjected to heat of 400F.

Results

My test allowed me to conclude that the less dense an object is, the more effective its performance as a heat shield. Not only did the 0% and 10% solid shields last longer, the temperature of the back of these shields rose steadily and slowly, whereas shields with higher densities survived for significantly smaller periods of time, and temperatures spiked quickly near the end.

Conclusions/Discussion

I devised an experiment that allowed me to test how density/infill affects a heat shield's effectiveness, using 3D printing to manufacture otherwise identical discs that were subsequently subjected to high temperatures. With repeated trials, I was able to determine that lower density shields were significantly more effective than their denser counterparts.

Summary Statement

I designed, manufactured, and tested heat shields with various infills, in order to determine how support structure density affects insulative properties.

Help Received

None. I designed and built my own materials, excluding the computer and heat gun, and performed the experiment by myself.