CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
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Project Number
34620

Project Title
Insulating and Light Transmitting Properties of Silica Aerogel

Abstract

Objectives/Goals
I was introduced to aerogel by my science teacher, and soon became curious about testing the insulating properties of silica aerogel against the properties of other common insulators. Based on my research, I hypothesized that a solid block of silica aerogel would be the most effective, then granular silica aerogel, then the aerogel PolarPad, then air, then polystyrene foam, and finally cardboard. I also wanted to test its light transmittance to explore the possibility of using silica aerogel in windows.

Methods/Materials
I performed a total of 256 thermal test results, using an i7FLIR camera measuring to the 0.1°C. I took three readings of the temperature of each insulator on a hot plate heated to 100°C (after waiting for the temperature to stabilize). I switched the position of the materials three more times, taking three readings in each location (for a total of 12), in order to eliminate the variation of temperatures throughout the hot plate#s surface. I tested the transmittance of the aerogel by measuring the lux of four different colors of LEDs, with and without the aerogel in front of them.

Results
For the temperatures taken on the 100°C surface, the average temperature of the solid silica aerogel was 44.4°C, the granular aerogel averaged 50.3°C, the PolarPad aerogel with glue averaged 48.5°C, the PolarPad with less glue averaged 43.4°C, the foam averaged 58°C, the cardboard averaged 62°C, and the air averaged 63.6°C. I added fiberglass and the Foamular board as test materials after I formed my hypothesis. The fiberglass averaged 50.5°C, and the Foamular board averaged 50.4°C.

Conclusions/Discussion
I cut the PolarPad open and observed glue saturating the aerogel inside it, which I found negatively impacted its performance, by approximately 2°C at 100°C, and by 6°C at 200°C. Based on these results, I believe that the PolarPad should not be made with glue. According to my results, the silica aerogel block was the most effective insulator among those tested, which supported my hypothesis, but perhaps not as significantly as a higher-quality aerogel. I believe that among the best everyday energy-saving uses for aerogel would be in refrigerators and freezers. Another application is in skylights (as indicated by the results of my transmittance experiment, because silica aerogel is translucent, but not transparent). Since aerogel is so expensive, I recommend using cheaper insulators for many applications.

Summary Statement
I tested the insulating properties and light transmittance of silica aerogel, and found it to be the most effective insulator of the materials tested, also with enough light transmittance to use as a translucent skylight /window insulator.

Help Received
I would like to thank my science teacher for inspiring me and loaning me equipment, my father for assisting me with experimentation and supervising safety, and my mother for editing/formatting my report and display board.