Super Plastic

Teacher Handout

Introduction

Many building materials have a high R-value, which is the measure of the material's ability to resist the flow of heat through it. Some examples of typical R-values recommended for home construction are listed below.

Location	R-value
Ceiling	R-44
Outside Wall	R-22
Basement	R-11

In the following activity you will compare the R-value of 3 similar appearing sheets of clear plastic. Clear plastic has been used for years in and around the home. Plastic wrap is very versatile and is used in a variety of applications. Each year many South Dakotans place plastic on windows and the sides of their homes to help reduce the amount of energy needed to maintain a comfortable environment. Plastic is used in new construction as a vapor barrier, increasing the R-value. Special types of plastic can be used to cover foods for potlucks and picnics.

*** This lab would make a great demonstration if you are short of materials for all of the students in your class.**

Materials:

3 - Different types of clear plastic (indicate the type using a marker)
These should be unknowns labeled 1 – 3. Clear plastic can be purchased at any building supplier or hardware store. I had 4 sides in the example shown below. Side 1 – open; side 2 – food wrap; side 3 – 2mil plastic; side 4 – 4mil plastic

1 – Heat source (lamp and bulb) – ***Careful risk of burn***
You will need to test which watt bulb works best with the setup you design. A 300 watt bulb was used in the example below. Each temperature probe was approximately 9.5 inches from the light bulb.

1 – Device to hold the plastic wrap
A fish stand was used in the example below. A standard folding chair would also work or any other items you may have in the classroom or lab.

4 – Thermometers (optional if choose qualitative approach of feeling difference with skin)
I suggest using thermometers for graphing purposes. Keep the distance between the bulbs and heat source consistent.

1 – Stopwatch (optional – could use a clock)

1 – Roll of tape

1 – Permanent marker

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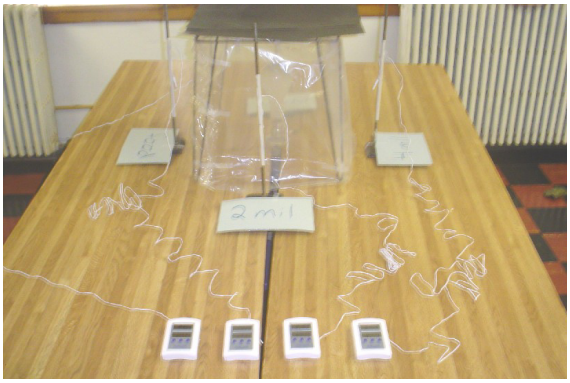
Procedure

1. Gather all of the materials.
2. Use a marker to indicate the type of plastic used.
3. Attach three different sheets of clear plastic to the holder using the tape. (4th side is the control - no plastic)
4. Place the heat source in the center of the holder – the heat source should be approximately 12 inches from the sheets of plastic. (Will vary with setup type)
5. Place the bulb of thermometers approximately 1-2 inches (estimate distance for control) from the outside edge of the plastic. (Will vary with setup type)
6. Record an initial temperature reading. (data table 1)
7. Turn on the light.
8. Take a temperature reading every minute for ten minutes (data table 1)
9. Clean your area per teacher's request.

- A typical setup is shown below (your setup may look different)



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Data Table #1 (Data will vary)

Trial #	Control	Material #1	Material #2	Material #3
1. (Initial)	84.9	84.9	84.7	84.7
2. (1min)	87.1	86.7	86.7	86
3. (2min)	89.6	88.5	88.5	87.3
4. (3min)	90.7	90	89.4	88.3
5. (4min)	91.9	91	89.8	88.7
6. (5min)	92.8	91.9	91.3	88.9
7. (6min)	93.4	92.7	91.5	90.1
8. (7min)	93.4	93.4	91.6	90.8
9. (8min)	93.7	93.4	91.9	91.4
10. (9min)	94.6	93.7	92.7	92.0
11. (10min)	95	94.5	93.1	92.1

Data analysis (questions)

1. Use the information from Table #1 to construct a line graph. Construct the graph using graph paper or construct it using the computer (teacher preference.) Time should be used for the independent variable (X-axis); the temperature change is the dependent variable (Y-axis). The data obtained for the control and the three separate sheets of plastic should be graphed on the same graph. Four lines will be graphed.

2. Which piece of plastic had the highest R-value? Normally the thickest plastic will have the greatest R-value. Some plastics will have an R-value included on the packaging. Your local lumberyard staff should be able to help locate the R-value of each piece if it is available. * As an extension – you may want your class to test different colored plastic.

Explain your choice. The plastic which allowed the least amount of heat to pass through will have the greatest R-value. This will be the line on the graph with the smallest slope. The slope of the line indicates the change in temperature over the change in time.

3. What are some practical uses for clear plastics with higher R-values? Covering windows, covering the sides of older homes, vapor barrier in construction, covering waterlines in basements, covering food displays in grocery stores.

Extension

4. Many South Dakotans use plastic to cover the ground in their rock gardens to prevent weed growth. A dark black plastic is a better choice for this type of application than a clear plastic. Why? The rocks or mulch covering the plastic will eventually settle, allowing light to pass through the plastic promoting the growth of weeds. Over time this will result in the possible breech of the plastic. Weeds may also continue to grow and work their way to the outside edge of the plastic.

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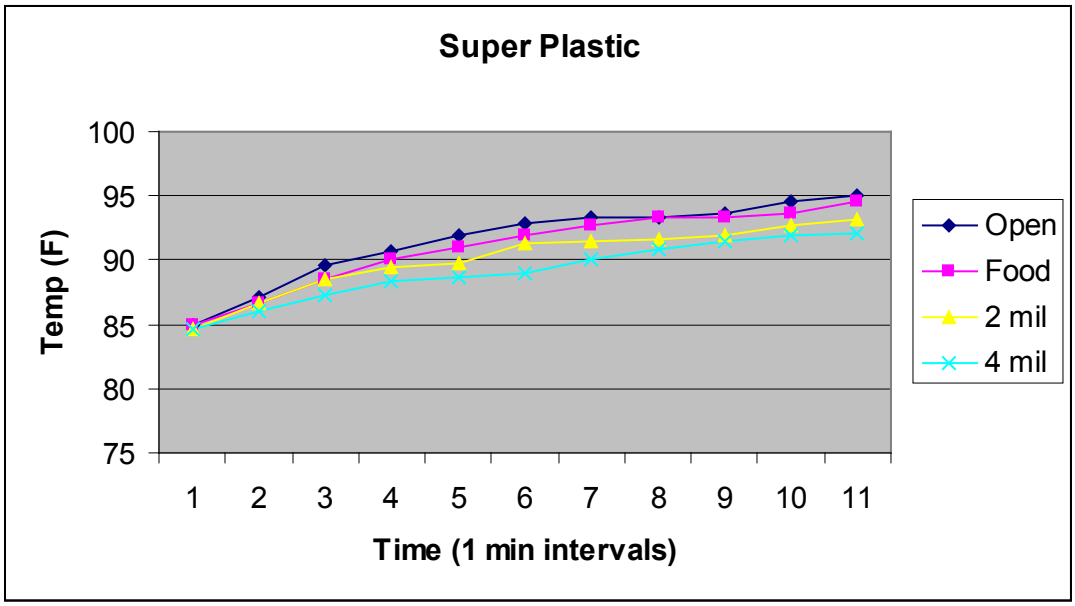
Example graph using Excel



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