PHYSICS 260 LAB 1

Thermal Expansion

1. overview

The goal of this lab is to observe thermal expansion and to and to determine if linear expanssion can be described by a liner model and if so, measure the thermal expansion coefficient of different metals.

When the temperature of a metal increases, the metal expands. For modest temperature increases the change in length of a metal rod is proportional to the temperature difference ΔT and to the original length of the rod L_0

$$\Delta L = \alpha L_0 \Delta T$$

α is called the coefficient of thermal expansion Then, $L = L_0 + \Delta L = L_0(1 + \alpha(T - T_0))$

2. Procedure

Measure the initial length L_0 (The inside length between the pin and the "'L"' bracket)and the initial temperature of the rods (probably room temperature unless you have been holding them).

(1) place the metal rod inside Support apparatus
(2) Read the measurement on the dial. At this dila reading the length is your initial length L_0.
(3) connect the DMM, read the resistance determine the temperature
(4) Attach the steam hoses and plug in the steam generator (after filling it with water).
(5) Wait for the temperature to rise.
(6) When the temperature is above $80°C$ for a minute or so, unplug or turn off the steam generator and wait 2 minutes.
(7) Measure the temperature and measure the length of the rod while the rod is cooling. Repeat as the rod cools for a total of 6 measurements of length and temperature each at least 2 min apart.
(8) Repeat this procedure for the other rods.

3. Analysis

Make a clean table of your measurements for each set of data. Graph length L vs. temperature T for each set of data. Fit a trend line to the data. Include error bars on your length measurements. How accurately was L measured. Discuss the slope and intercept. Does the data look linerar? Explain Also, make a graph of $L - L_0$ vs $T - T_0$.Include error bars on your length measurements. How accurately was $L - L_0$ measured. Fit a trend line to the data and explain the slope.

Determine the expansion coefficient and the error of the expanssion coefficient and compare with expected (book) values. Discuss your agreement or disagreement.

4. What to Turn In

What the experiment is about and what we are trying to show. A description of the experiment, data, a clear analysis of the data. A statement of your results. Any conclusions that can be made.