

Thermistor Characteristics

Motivation and Aim

Resistivity of materials is a function of temperature. For certain semiconductors, the change in resistivity with temperature can be very rapid. Such materials can be used to make resistors with high temperature sensitivity, and are called thermistors. They can be used as temperature sensors.

Apparatus

1. A thermistor
2. A mercury thermometer
3. A water bath
4. Electric heater
5. Ice

Procedure

The thermistor is connected to a voltage source and placed in a water bath. The temperature of the water bath is changed and at each steady temperature its resistance is determined using a precision multimeter. Measurements are repeated for several temperatures, both as the water heats up and then again as it cools down. Further, the temperature is reduced by introducing ice to the bath and taking readings as the water cools and then as it return to room temperature.

Theory

The temperature dependence of the resistance of a semiconductor can be modelled as

$$\frac{1}{T} = A + B \ln(R) + C [\ln(R)]^3$$

Analysis

After plotting a graph of $1/T$ vs. $\ln(R(T))$ where R_T is the room temperature, the coefficients can be determined by a cubic fit to the data.

Points to Ponder

1. On the basis of observations can you find a range in which a thermistor is a linear device device?
2. Is a thermistor more useful for measuring accurately small changes, or large changes, in temperature?