FREEZING POINT OF GLACIAL ACETIC ACID (#5.1)

The CCLI Initiative
Computers in Chemistry Laboratory Instruction

Learning Objectives

The objectives of this experiment are to...

- illustrate how an experiment program is created and executed using the ***MicroLAB*** Interface.
- demonstrate the general features of a cooling curve.
- measure the freezing point of a compound.

Background

The freezing point of a liquid is the temperature at which a liquid turns to a solid. In this experiment you will measure the freezing point of an organic compound, glacial acetic acid. A sample of the compound, which is a liquid at room temperature, will be cooled until the temperature is well below it's freezing point. The temperature will be monitored with an electronic temperature probe. A graph of temperature *versus* time (called a cooling curve) will be made which should look like the graph in the Figure 1 below.

Note that the graph shows the temperature first dropping as the liquid is cooled, then remaining constant when both liquid and solid phases are present. It finally drops again when only solid phase is present. The freezing point is the constant temperature of the solid-liquid mixture. It is not uncommon for liquids to exhibit supercooling as shown in the figure.

Calibrating the temperature probe.

You will obtain at least three calibration points for the temperature probe to insure a good calibration.

Setting up the apparatus

The apparatus for this experiment is a 6 inch test tube and a beaker of ice/water slush.

Running the experiment

1. For the first experiment, clamp the test tube containing the glacial acetic acid directly into the ice bath, and **DO NOT** stir the liquid.
2. For the second experiment, set up the apparatus exactly as shown in the diagram above. As soon as the tube containing the acetic acid is immersed in the ice mixture, begin constantly swirling the test tube as the cooling curve data is collected until solid forms.
3. Once the glacial acetic acid begins to freeze, the curve will flatten out, and begin to descend again after all of the liquid has solidified.

Determining the freezing point

Guidance is given the student in determining the desired data.

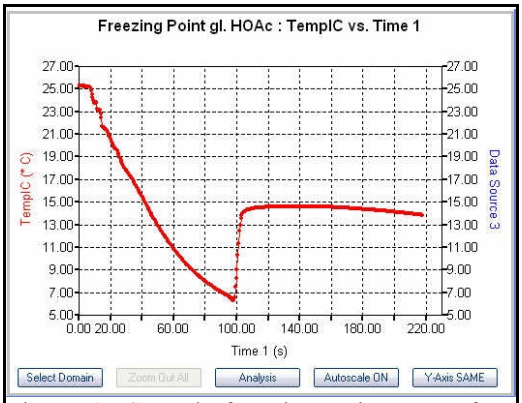

Figure 1. Sample freezing point curve for glacial acetic acid. The dip and sudden rise is due to super cooling.

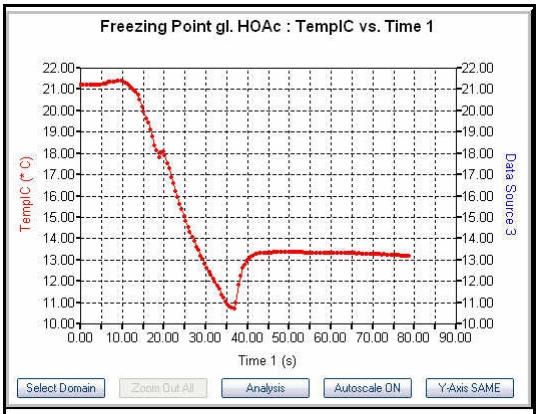

Figure 2. Freezing point curve for glacial acetic acid with rigorous stirring. Notice there is not as much super cooling.

Instructor Resources Provided

1. Sample Report Sheets providing the format to organize the data collection with sample data.
2. Questions to consider, answer and turn-in with suggested answers.
3. Tips and Traps section to assist the instructor with potential problems and solutions.
4. Sample ***MicroLAB*** screen shots and graphs.
5. Laboratory preparation per student station.

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