

PIE (Phase Diagram Experiment) – In class demonstration.

Ga-In melting behavior demonstration

Duration: ~20 min

Prerequisites: none. This activity is designed for students who have never worked with multi-component systems before.

Material needed:

- 1 piece of gallium.

Tip: To prepare the gallium, place the piece in a beaker and place the beaker in hot water. Once the gallium is fully melted (temperature of melting point = 29.76 °C), pour the gallium in a silicon ice cube tray and keep the tray in the freezer until the beginning of the class.

- 2 pieces of indium: one large, one small.

You can find these two metals online (prices listed are prices on 03/31/2025):

\$89.99: 100g of [Gallium](#)

\$72.99: 100g of [Indium](#)

- A scale
- Paper towels
- Gloves

Demonstration:

- 1) Weight the cube of gallium and the small piece of indium separately.
- 2) Rub them together for a couple of minutes. The students should be able to see that melt has started to form. We recommend wearing two pairs of gloves to limit the influence of body temperature.
It's a good moment to start a class discussion and ask them to formulate hypothesis on what they think happened.
- 3) Use a paper towel to wipe off all the liquid.
- 4) Weight the cube of gallium and the small piece of indium separately again.
- 5) Students can now estimate the respective proportions of gallium and indium that melted.
- 6) Repeat the experience using the large piece of indium. You should obtain a similar result.
Continue the class discussion.

Assessment:

At the end of the demonstration, the students should have understood that the initial melting temperature does not depend on the respective weight of the two metals. The phase diagram for gallium-indium (Ga-In) binary system is provided on the next page. The instructor can choose to show it to the students or not.

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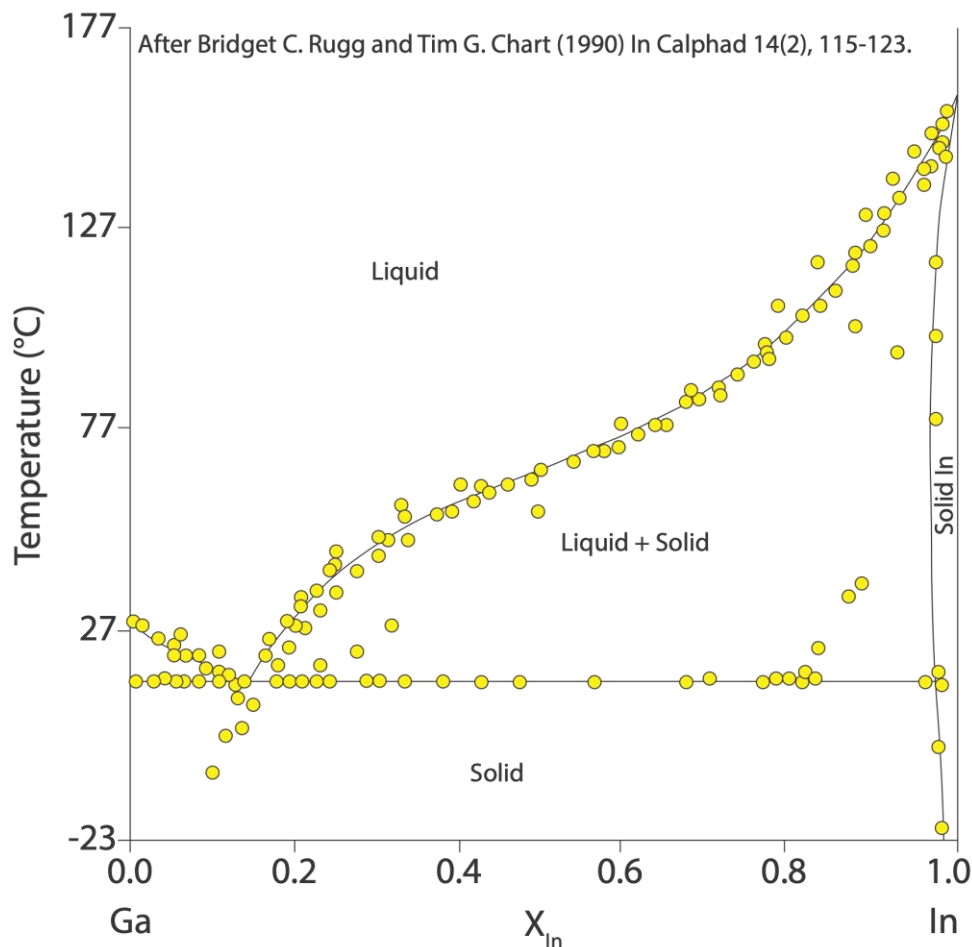


Figure 1. Binary phase diagram of gallium (Ga) and indium (In) determined through laboratory data (indicated by the yellow circles) by Rugg and Chart (1990). X_{In} = mass fraction of indium.

Reference:

Bridget C. Rugg, and Tim G. Chart (1990), A critical assessment of thermodynamic and phase diagram data for the gallium-indium system. *Calphad*, 14(2), 115-123, DOI: 10.1016/0364-5916(90)90013-P.

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