Mold Casting with Plastic

Learning Objectives	1) Students will be able to define casting and identify relevant industrial applications. 2) Students will be able to identify possible challenges during casting based on the object's final form and mold/casting materials used.
Time	1 hour
Topics	1) Casting 2) Chemical reactions

Before the Lab:

Supplies to buy every time you run the activity:

1) Plastic cups or other disposable container for mixing of polymer components
2) Tongue depressors
3) Gloves

Supplies to buy once:

1) Safety glasses for each student

Supplies to buy as needed:

1) Pigment for coloring the polymer
2) Smooth Cast 300 or similar two-part fast reacting polymer for casting

Prior Knowledge Recommended for Instructor:

1) Understanding of casting
   - Importance in society as a whole
   - Different materials and molds possible
2) Possible complications during metal solidification and polymer reactions

Prior Knowledge Recommended for Students:

1) Basic understanding of chemical reactions

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Lab Set-up:

1) We run the lab with groups of 5 students.
2) Measure out equal portions of polymer A and B into separate cups.
3) Before the students arrive, make sure each station has:
   - gloves
   - safety glasses for each student
   - polymer A
   - the students' molds at their table spots
4) Prep dye for portioning (if possible).

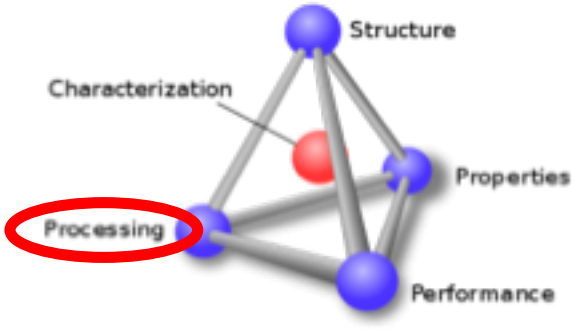
Pre-lab Questions:

1) The casting activity fits into the processing category of the tetrahedron. Please explain why casting fits into processing.

The final product is made by combining two materials together (chemical processing).

2) What kind of materials can you cast?

Metals, polymers, essentially anything that can be poured



Running the lab:

1) Have the students sit at their stations and put on their gloves and safety glasses.
2) They should have already answered the pre-lab questions. Ask the students if they had any unresolved questions about the pre-lab questions.
3) Instruct the students to **read all of the directions**. At a certain point they will be asked to answer a concept/design check question. They will need to check their answer with a TA/instructor in order to get a certain piece of necessary equipment (polymer B).
4) Do not give them the instructions verbally. The goal is to get the students to read everything and think about why they are doing what they are doing. At this point let them jump in but encourage them to raise their hands if they have questions.

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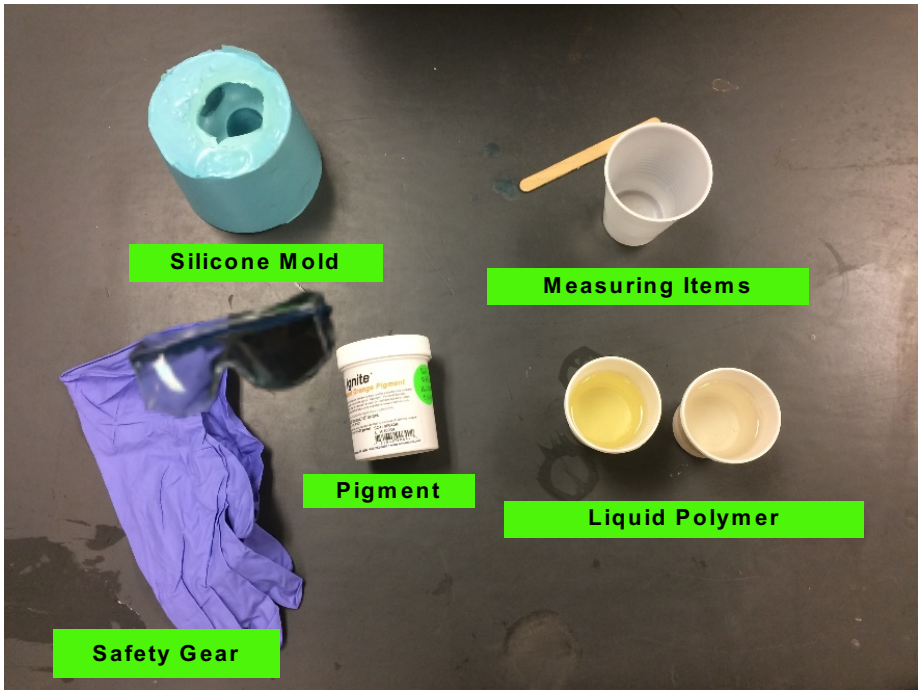
Sample Station:



Safety note:

Make sure students are wearing safety glasses and gloves at all times. The reaction between the polymer and the cross-linker is extremely **exothermic**. Inform the students that the cup they mix the polymer in will get uncomfortably hot.

Concept Check:

The concept check here reminds students that this reaction released heat whereas the previous polymer mixing to make the silicone mold did not. They are asked to distinguish the two reactions based on this observation.

This reaction is exothermic, while the other was most likely endothermic. After the students have explained their reasoning, give them polymer B.

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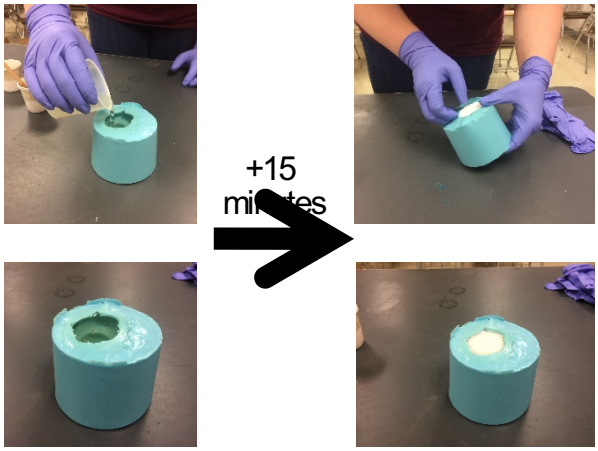
Casting your object:

1) Pour out equal amounts of each polymer
2) Mix thoroughly. Add color if desired.—Lab assistants do this.
3) Once color is added, quickly pour the liquid polymer into your silicone mold.
4) The process happens very fast (<15 minutes). The surface will change from clear liquid to a milky solid (see bottom two pictures).
5) Once cool and hard to the touch, very carefully peel your object from your mold. Assist if needed.



Discussion points to cover after the activity:

1) If you have a two component resin system, why is it important to mix the two components very well?

1) What types of objects would be very difficult to cast? Why? Can you think of a different way to approach the problem?