

Scientific Glassblowing

Introduction

Glassblowing is a skill that has historically been taught in chemistry classes because of its utility in experimental work in chemistry. In recent years, scientific glassblowing has gone into decline, whereas art glass is again in fashion. Technically speaking, what we do in CHEM 301 lab is called flameworking or lampworking, and the term glassblowing refers to the use of a furnace and glory hole with 5-foot-long blowpipes and punty rods. This laboratory introduces you to some of the basic techniques of scientific glassblowing and gives you an appreciation for the skill required to manipulate hot glass.

Procedure

The instructor first demonstrates some of the safety and scientific procedures important to scientific glassblowing. Students then manipulate hot glass using an oxygen-natural gas hand torch. All work is done with Pyrex, a borosilicate glass commonly used in scientific glassware. After annealing, students may take home the objects they have produced. Some of the techniques and exercises include:

- Cutting small-diameter rod and tubing by scoring and snapping
- Cutting large-diameter tubing by scoring and heat-shocking
- Cleaning and drying glass before use in the flame
- Carrying glass around the room
- Lighting and extinguishing the torch
- Fire-polishing rough ends
- Flame cutting
- Blowing a test-tube bottom
- Butt joint (or butt seal) with tubing
- Tee joint (or "T" seal) with tubing
- Flame and furnace annealing
- Use of a polaroscope to visualize internal stress

Report

There is no formal report for this lab. You are, however, expected to fabricate a test-tube bottom, a butt joint, and a tee joint.

References

The spiral-bound text "Glassblowing: An Introduction to Artistic and Scientific Flameworking" by Edward Carberry (MGLS Publishing, Marshall, MN, 1979) and the paperbound pamphlet "Laboratory Glass Blowing with Corning's Glasses" (Corning Glass Works, Corning, NY, 1977) are two useful books. Departmental copies of these books are available in the lab and may be taken home overnight. These are good if you'd like to learn more about glass, but experience and watching others will be a better guide.

If you'd like an on-line description of the techniques used in this lab, visit the web site:
<http://www.ecu.edu/chem/glassblowing/gb.htm>

For more information about glass, glassmaking and glassblowing, the Corning Museum of Glass, located in Corning, NY has the world's largest glass library and perhaps the most impressive collection of glass. They also have a nice web site. The URL for the education portion of their web site is:

<http://www.cmog.org/Education/edglass.htm>

Please read the safety information on the next page.

Safety Notes

Fires and burns are the obvious dangers associated with glassblowing. Your instructor demonstrates safety procedures at the same time as experimental procedures. A list of safety reminders, taken from the Winter Study course on glass and glassblowing, follows.

1. Safety goggles, didymium glasses, or regular eyeglasses must be worn at all times in the laboratory regardless of whether you are handling glass.
2. Do not wave long pieces of glass about in the air. Long pieces of glass should be carried in a vertical orientation.
3. Do not waste glass. Determine the minimum convenient lengths and reuse short pieces whenever possible.
4. Do not mix soda glass (soft glass) and Pyrex (borosilicate glass). Use only the clear and colored Pyrex glass supplied. Mixing different types of glass can result in an explosion hazard.
5. Do not heat large glass objects, e.g. bottles, which are likely to explode.
6. Glassblowing should be done only during designated class times, under the supervision of the instructor or a qualified professional.
7. Move carefully and slowly while working near a burner.
8. Turn on natural gas first, light the burner, and then slowly turn on the oxygen. To extinguish a flame, turn off the oxygen first, then turn off the natural gas.
9. Turn off the oxygen and reduce the size of the gas flame whenever you are not heating glass. Both of these gases cost money.
10. To prevent long hair from ignition, it must be restrained behind your head.
11. Burned skin should be immediately immersed in cool water. Report all accidents to the instructor.
12. Everyone should be aware of the location of the fire blankets and exits.
13. At the end of a session of glassblowing, the oxygen cylinder should be closed at the stem valve, and the remaining pressure in the gas regulator should be "bled off" in a flame. The instructor will demonstrate this and all other techniques.
14. At the end of a class period, you should separate out all usable short pieces of glass, sweep all scraps into a broken glass container, leave your tools in order, and check to make sure that the oxygen and natural gas have been properly turned off.
15. Glass objects which you intend to keep, or which will be placed on display, should be properly annealed in the annealing oven.
16. No food or drink in the lab. A water fountain is available down the hall, near the restrooms.
17. Please notify the instructor whenever you leave the room.
18. No list of safety reminders is complete. Use common sense and ask questions when you are unsure of proper procedures.