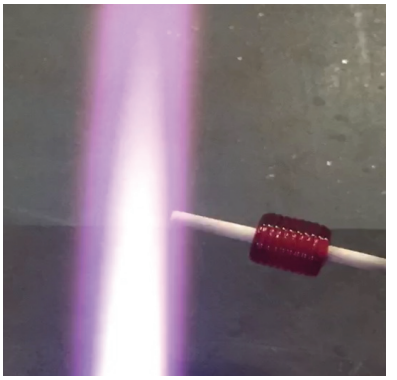
DOUBLE HELIX GLASSWORKS | *Made for the Flame*

Working with Reduction Glasses

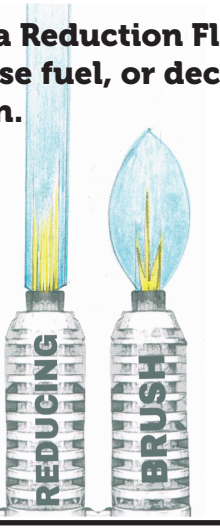
The Reducing Process

1. Work in a neutral flame

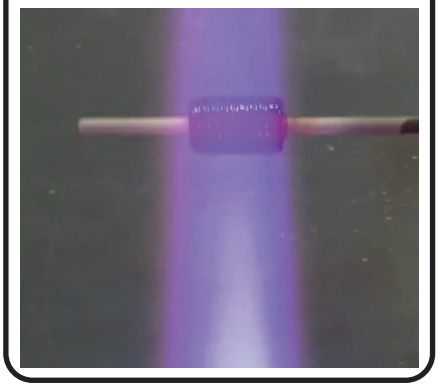
2. Cool until the glow is gone.



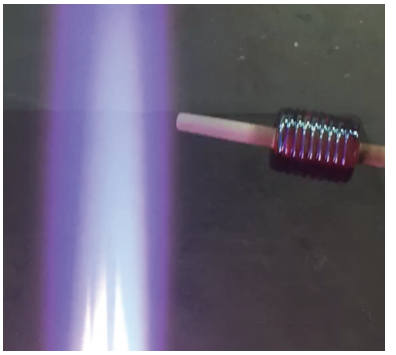
3. Set a Reduction Flame; increase fuel, or decrease oxygen.



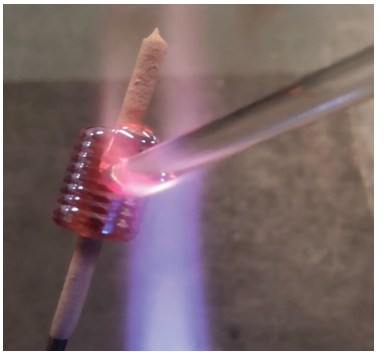
4. Briefly, expose the glass to the reduction flame. (5-10 seconds)



5. If more reduction is desired, repeat step 4, with cooling between exposures.



6.For the pearlescent effect, encase in clear, without exposing the luster to the flame.



Reduction Color Theory

Reduction colors contain silver dissolved in the glass matrix as silver oxide (Ag_2O). Upon exposure to a flame deficient in oxygen, the Ag_2O gives up its oxygen to the flame, leaving behind a thin layer of metallic silver. This metallic layer can be left on the surface or encased in clear glass. A neutral or slightly oxidizing flame should be used during gathering, working, and shaping to preserve the silver in its oxide form. When the glass is ready to be reduced (after cooling) the flame is adjusted by increasing the fuel or decreasing the oxygen. The glass is then briefly exposed to this reducing flame.

Controlable Variables

1.Flame Chemistry

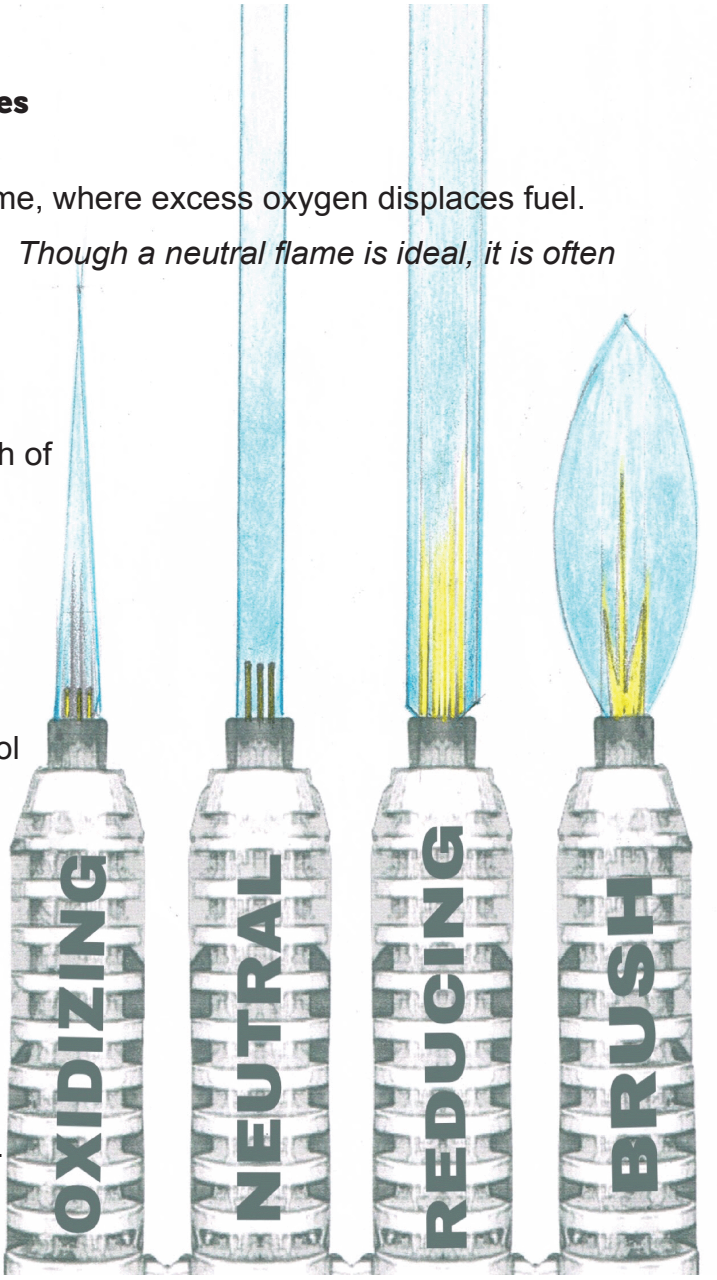
• Oxidizing Flame - displays hollow areas inside the flame, where excess oxygen displaces fuel.

• Neutral Flame - has even balance of fuel and oxygen. *Though a neutral flame is ideal, it is often simpler to adjust the torch to slightly oxidizing.*

• Reducing Flame - has stretched candles.

• Brush Flame - a short, low velocity reduction flame.

* The chemistry of the flame also varies along the length of the flame,with areas closer to the fuel jets being more reducing than at the tip.



2.Different Torches

Different torches have a range of possibl flame settings. Spend some time exploring the settings of your torch and get comfortable dialing them in. The more control you can have over your oxygen and your fuel, the better. We do not recommend using a hothead. We most frequently use, Nortel's Arrow or GTT's Lynx with propane and an oxygen concentrator.

3.Heat

Though reduction is a chemical process, heat plays a role. The glass must be cooled before reducing or the luster can muddy. Limiting the beads thermal gain during the reduction process will result in a cleaner luster. You can limit the heat by;

- Cooling the bead before reduction and
- Using a cool reduction flame or
- Using repeated brief exposures to the reduction flame with a few seconds of cooling between exposures.

Trouble Shooting Reducing Glasses

A. No Reduction – not cooling the glass long enough before reducing or too weak of a reduction flame.

B. Muddy colors- too much reduction or too much heat.
   a. Test your neutral flame. Hold a rod of reducing glass in it for a few seconds. If it develops a metallic sheen on the surface, then it is not neutral. Adjust by increasing your oxygen or decreasing your fuel.
   b. Reduce for shorter periods, at the tip of a cool reducing flame with enough cooling between reductions to prevent the glass from glowing again.

C. Losing the luster in the kiln –annealing temperature is too high. We anneal at 920-950°F. You can also try putting activated charcoal in your kiln.

D. Erasing the luster – you can burn off the metals from the surface of the glass if it isn't muddy yet. Adjust your torch to an oxidizing flame and erase the luster.