

Class Overview

- Short history
- Safety
- Tools
- Types of glass
- Lighting the torch
- Regions of the Flame
- Introducing glass rods into the torch
- Make a gather
- Creating stringers
- Creating twisted cane
- Making a bead
- Common Shapes of beads
- Common Decorations of a bead
- Annealing cycle
- It's your birthday

Short History

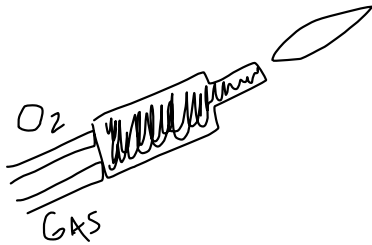
Glass was discovered or "created" somewhere between 2600 BC and 2400 BC. Many theories have developed around where and how the first glass was 'made', but my favorite one is that a lightning bolt came down onto a beach where there was a perfect mix of ash and sand. (a camp fire?) The extreme heat of the lightning bolt created a lump of glass. (this is probably not true, but is fun to think about)

Safety

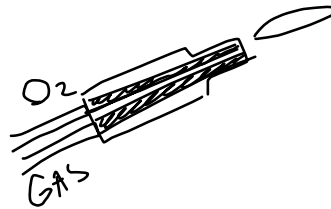
- Fire Safety
 - working with an open flame.
 - Concrete floors are the best, then tile... NO CARPET
 - Propane is heavier than air, so if the propane can leaks, this can fill up your studio. Keep propane cans outside.
 - Have an 'up to code' fire extinguisher
- Ventilation
 - Good airflow is a MUST!!! And away from your face
- Eye Protection
 - Flames generate infrared rays. Use Didymium glasses or welders (G-2) glasses. The welders glasses have a green color to them which makes it more difficult to see the colors of the glass rods.
- Hot Glass
 - Yes, the glass is HOT! Always know which part of the glass is hot. However, if a hot bead falls onto your lap, stand up. We will get the bead later.
 - If you burn yourself, There are lots of burn ointments out there. I like Aloe Vera Gel either from the plant fresh, or from a bottle from a health food store.
 - If you cut yourself, wash the cut and use a bandage.

Basic Tools

- Torch
 - o There are 2 types of torches. A Pre-mix and a Surface mix.
 - Pre-mix is where the oxygen and gas come into the torch handle and mix in an open chamber in the handle, then at the tip of the torch they burn together. This creates a very strong and hot flame. Excellent for borosilicate glass.
 - Surface mix is where the oxygen and gas come into the torch handle. The two gasses stay separated by tubing inside the torch handle until at the tip. At the tip of the torch they open they burn together. This makes a softer quieter flame (more expensive torch). Excellent for soda lime glass.
 - My first torch was the MINOR from Nortel. This is an excellent torch. I still use this torch when I am traveling. A great work horse!!
 - * Attach your torch to your table or bench using a c-clamp or screws or bolts.



Per-mix



Surface mix

- Work Surface
 - o A fire proof surface is a must!
 - Cement board like Hardibacker (Home depot or Lowes)
 - Sheet metal
 - Tiles
 - Even drywall is flame resistant
 - o Have your surface level
 - Really awful when your glass rods roll off of your table.
- Eye Protection
 - o Flames generate infrared rays. Use Didymium glasses or welders (G-2) glasses. The welders glasses have a green color to them which makes it more difficult to see the colors of the glass rods.
- Tweezers
 - o A tweezer with a rounded end with or without serrations is used as an extension of your fingers. (Edward tweezer-hands)
- Marver
 - o A flat surface that is used to shape glass.
 - Graphite, does not remove much heat from the glass. Will not stick to the glass.
 - Steel or Brass, great metal marvers. Great for pushing or grabbing the glass. May stick to the glass if the metal gets too hot.
- Water
 - o In a can will keep your tools from sticking to the glass. Keep them cool. A place to deposit bits of glass.
- Pick
 - o A sharp piece of steel or tungsten that is used in raking, plunging, poking, and feathering glass
- Knife
 - o A good all around shaping tool

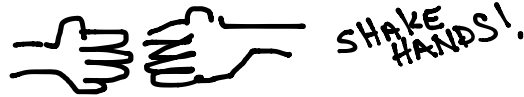
- Annealing Kiln
 - o I prefer one that has a digital controller. But, a simple pyrometer and thermocouple is a great start! (then save up for a detached controller that you can add later to your kiln).
 - o If you are only making small beads, you can anneal them in a bucket of vermiculite. This can be purchased at a plant store. Vermiculite is a great insulator. However, I would then batch anneal these beads at a later date. (Batch anneal : to anneal a large load of beads or (batch) after they have all been made) We will be annealing them as we work. *OR Anneal the Bubbles*
- Mandrel
 - o This is where the magic of the hole comes from. A stainless steel rod. Many sizes are available. We are using 3/32" rod.
- Bead Release
 - o Shake really well (in fact, I have placed 3 beads in my bottle of Bead Release so when I shake it, the beads help stir the contents.) Bead Release is a clay type of material that is used on the mandrel so that the bead does not stick to the stainless steel mandrel.
- * Clothing: wear natural fabrics. These will not melt if a piece of glass falls on it.
- * Maintenance: Change your gas hose every few years. They tend to start leaching out gas.

Types of Glass

Note: you must use the same COE on the same bead. You can not mix different COE glass!!!

- What is COE? Coefficient of Expansion. (or actually the Coefficient of Thermal Expansion) The number is the amount of change in volume in response to a change in temperature. Thus, the smaller the number, the less the glass volume changes with temperature.
- COE 33: Borosilicate: . This is the same glass that is used to make cookware. Borosilicate can withstand quick changes in temperature (in and out of the oven, microwave...etc...) Glass tubing makes for easy glass blowing
- Coe 82: Float glass: or window glass. Very inexpensive. Very susceptible to devitrification (or becoming un-glassy)
- Coe 90: Tested compatible. Great for torch work and kiln forming
- COE 96: Lower cost than Coe 90 glass. Usually compatible with furnace blowing and casting.
- COE 104: (what we are using) Glass rods for torch work less expensive. Large selection of color choices
- COE 108: (Schott Clear): Very clear. Usually compatible with 104.
- COE 120: (Satake) Holds heat for a very long time. Long working time.

Lighting the Torch.... Your NEW BEST FRIEND!!

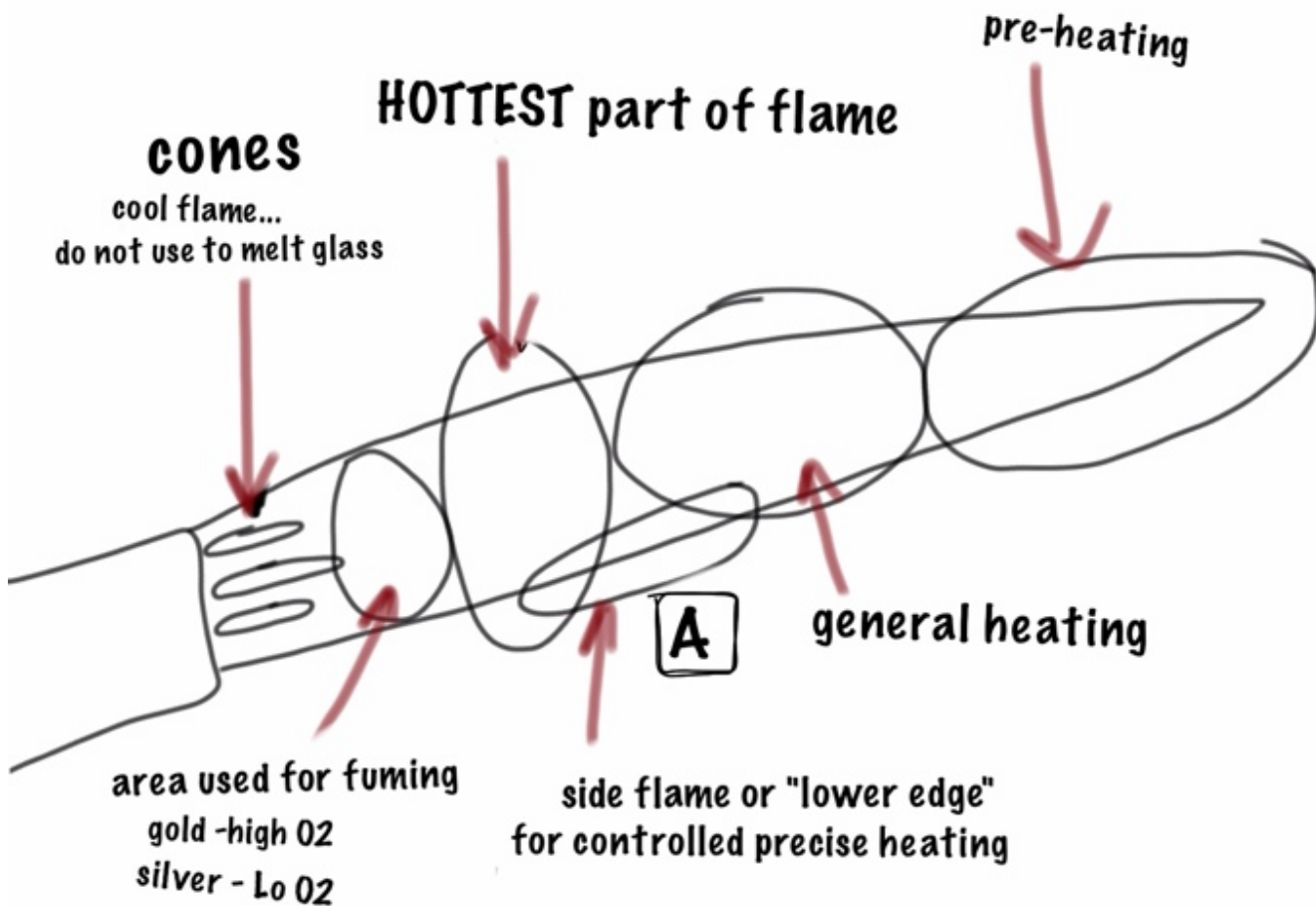


- Propane is Heavy....
- Oxygen is Light
- Turn on the propane ... just a little, maybe 1/8 of a turn. Wait a couple of seconds, hold the striker just a bit under the end of the torch, spark the striker... and tada!!! A small flame.
- If the flame does not magically appear, turn the propane on a bit more. Wait.. wait... try the striker again.
- If you hate using the striker, use a match.
- Do not turn on the propane a large amount. This will cause a large flame burst out... (kind of scary, but you won't get hurt)
- Once the propane is lit, turn on the oxygen. Slowly, until you get a good flame.

Note: Types of flames: Reduction flame : very soft and bushy. can leave junk on the glass ... be careful
Oxidizing flame: very hard and tight flame. can burn the glass, be careful

some glass needs either a reduction flame or oxidizing flame to bring out hidden talents....ie colors

Regions of the Flame



(Keep bead in **A area when making a bead)**

(from Contemporary Lampworking by Bandhu Dunham)

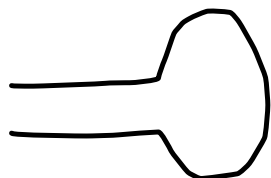
Introducing glass rods into the torch

- Hold the glass rod like a pencil or hold it like a tennis racket
- Slowly introduce the rod into the flame at the coldest part. Aim the glass toward yourself. (smallest area to heat up is the end of the rod, less likely to thermal shock)
- Once the tip is hot, bring the rod closer to the tip of the torch.

Make a Gather

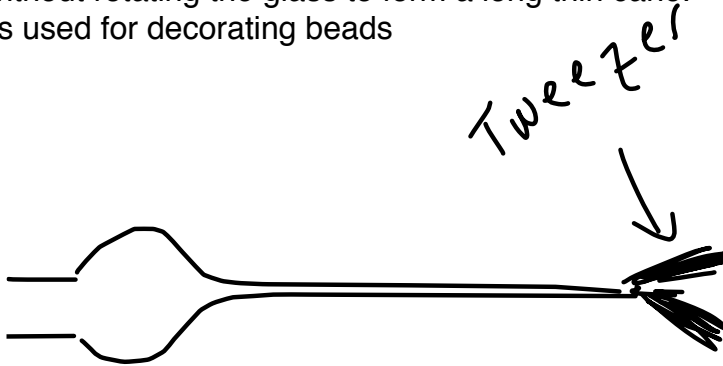
- With the glass hot and in the torch, rotate the glass to equally heat all the way around the rod. Hot glass wants to ball up. Let it. This is a gather. Raise the hot end of the glass to create a larger and more flat gather. Lower the hot end of the glass to keep the gather smaller and elongated.

note: glass is a poor conductor of heat, so you can hold it pretty close to the flame!!! YAY!!!



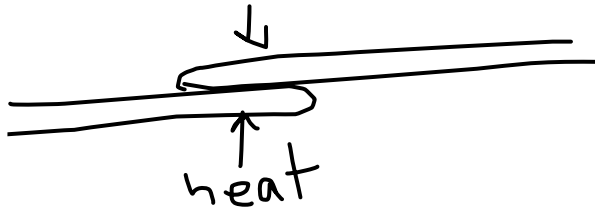
Pulling Stringers

- Make a gather of glass
- Remove the gather from the flame, and let cool for about 2 seconds
- Grab a small amount of glass with either your tweezers, or a punty (another glass rod)
- Pull without rotating the glass to form a long thin cane.
- This is used for decorating beads



Twisties or Latticino

- Pre-heat an inch or so length on 2 rods.
- Lay the hot ends on top of each other
- Tack melt together
- Remove from the flame, let the surface of the rods cool
- Pull and twist in opposite directions.

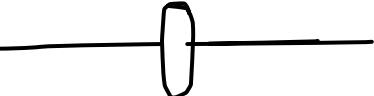
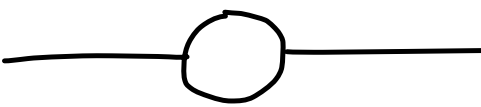


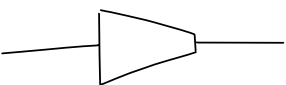

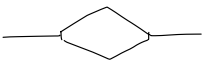


Winding a Bead




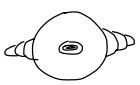

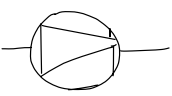
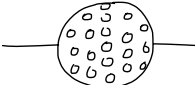

- Pre-heat the mandrel. (the bead release will go to a white-ish ash color when hot and dry)
- Pre-heat a glass rod.
- Make a gather
- Touch the gather onto the heated mandrel
- Rotate the glass rod as you wind the glass onto the mandrel. (the bead is under the flame, the glass rod is through the flame)
- Tap your head and rub your tummy at the same time
- Keep the bead warm. (this is COE 104, does not like thermal shocks)
- The amount of glass on the mandrel need to be at least the same thickness of the mandrel on each side.
- Shape the bead
- Flame polish to remove any chill marks
- Decorate the bead
- Place the bead in the annealer. (look at the color of the bead. The glow of the heat should be a super dull red, DO NOT PLACE HOT SUPER GLOWING BEADS IN THE ANNEALER they will droop, and stick to other peoples beads.... Not cool)
- Get another mandrel and do it again!!!

check your posture!!! Take breaks!!! breathe!!! blink!!! drink water!!! maybe some armrests?

Common Shapes of beads

- Roundel or Donut 
- Round 
- Cylinder 
- Barrel 
- Cone 
- Heart 
- Bi-cone 

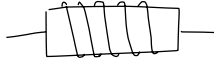
Common Decorations of a bead

- Dots
 - o Dots 
 - o Layered dots 
 - o Raised dots 
 - o Stacked dots 
 - o Plunged dots 
 - o Triangle dots 
 - o Full coverage of small dots 
 - o Raked dots 

Drink Some Water — Breathe, Breathe, — BLINK

- Trailing

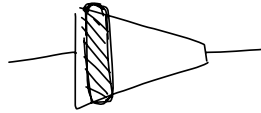
- o Trailing



- o Feathering



- o Adding a twisty

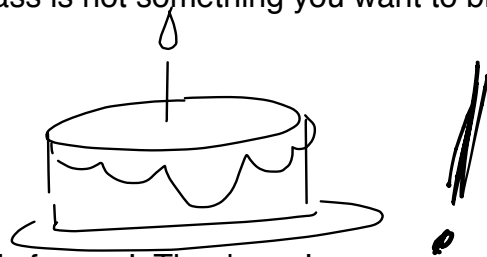


Finishing the Bead

- Anneal your beads! This relaxes the molecules in the glass and aligns them into an orderly fashion which gives strength and order to your beads. If your beads are small (like what we are making today) you can put your beads in a bucket filled with vermiculite. Vermiculite is a natural insulator and the beads will cool gradually. But, please, when you get to an annealer, anneal them as a batch. Put all of your beads in a cold kiln, ramp up the kiln slowly and then anneal them
- The annealing cycle we will be using in class is:
 - o Set the kiln to 950 deg. F. this is the annealing temperature of COE 104 glass.
 - o When the last bead goes into the kiln, let the beads soak for ½ hour. This will remove the stress in the glass
 - o Ramp down 600 deg. / hour to 700 deg. Soak for 10 minutes
 - o Ramp down 600 deg. / hour to 400 deg Soak for 0 minutes
 - o Turn off kiln.
 - o It's that easy!!

It's your birthday!

- Everyday is like your birthday. Opening the kiln, and seeing wonderful presents waiting for you!
- The next day, or when the kiln has reached room temperature (or close to it) remove the beads from the kiln.
- When the beads are COOL, place in a bucket of water (this helps soften the bead release)
- Hold onto the mandrel tight. I use a bench vice, but a good pair of vice grips will work.
- Twist, twist, twist the bead off the mandrel
- Clean the hole of the mandrel by using a reaming tool. There are many out there in the world of glass. I use a diamond reaming tool in a Dremel type of tool. Please clean all beads under running water, or under water in a bucket. The dust of glass is not something you want to breath. (and dry glass reduces the life of diamond tools)



By Bronwen Heilman ©2023

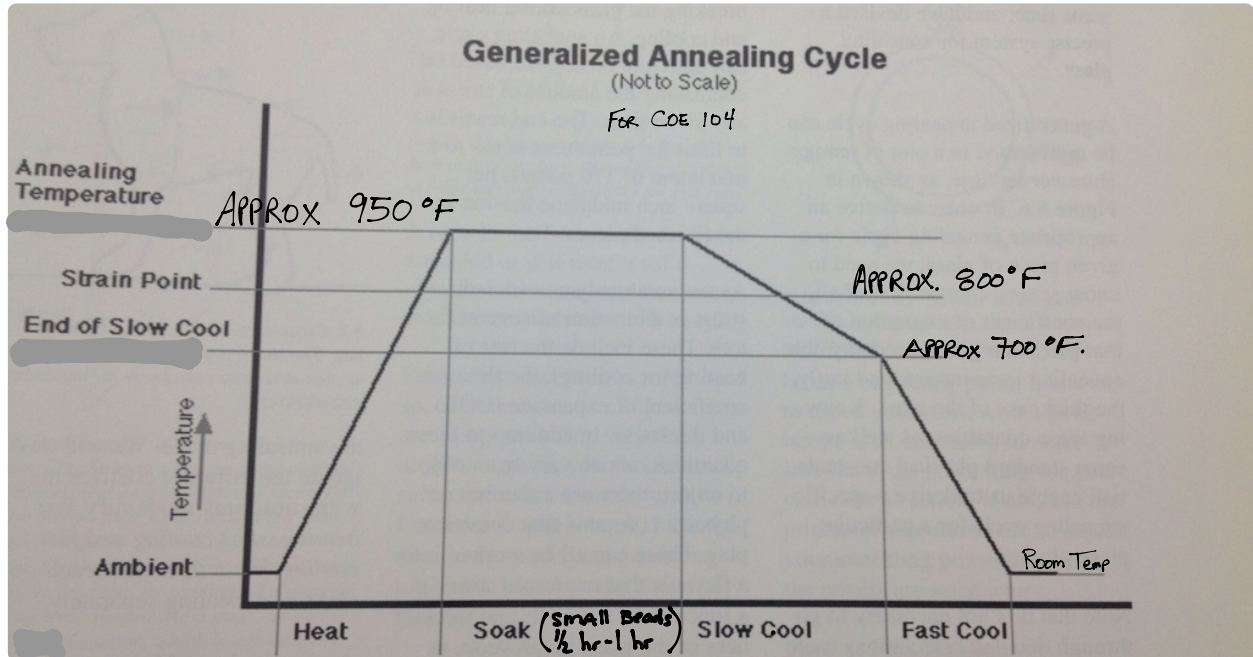
Please do not share this information with anyone. This is for you! Thank you!

-Bronwen

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Annealing Cycle for COE 104 glass



(from Contemporary Lampworking by Bandhu Dunham)

list of Suppliers....**(very incomplete!!!!)**

(this is just a few of the suppliers, please check the web for a much larger list!)

ABR – Glass, Tools and equipment

Abrimagery.com 812-339-9147

Arrowsprings – tools and equipment

www.arrowsprings.com 1-800-899-0689

Frantz Art Glass – Glass, Tools and equipment

www.frantzartglass.com 1-800-839-6712

Wale Apparatus - Glass, tools and equipment

www.waleapparatus.com 1-800-334-wale

Kilns:

Arrowsprings

www.arrowsprings.com 1-800-899-0689

Paragon – www.paragonweb.com 972-288-7557

this is a partial list. There are lots of suppliers, and kiln manufacturers...