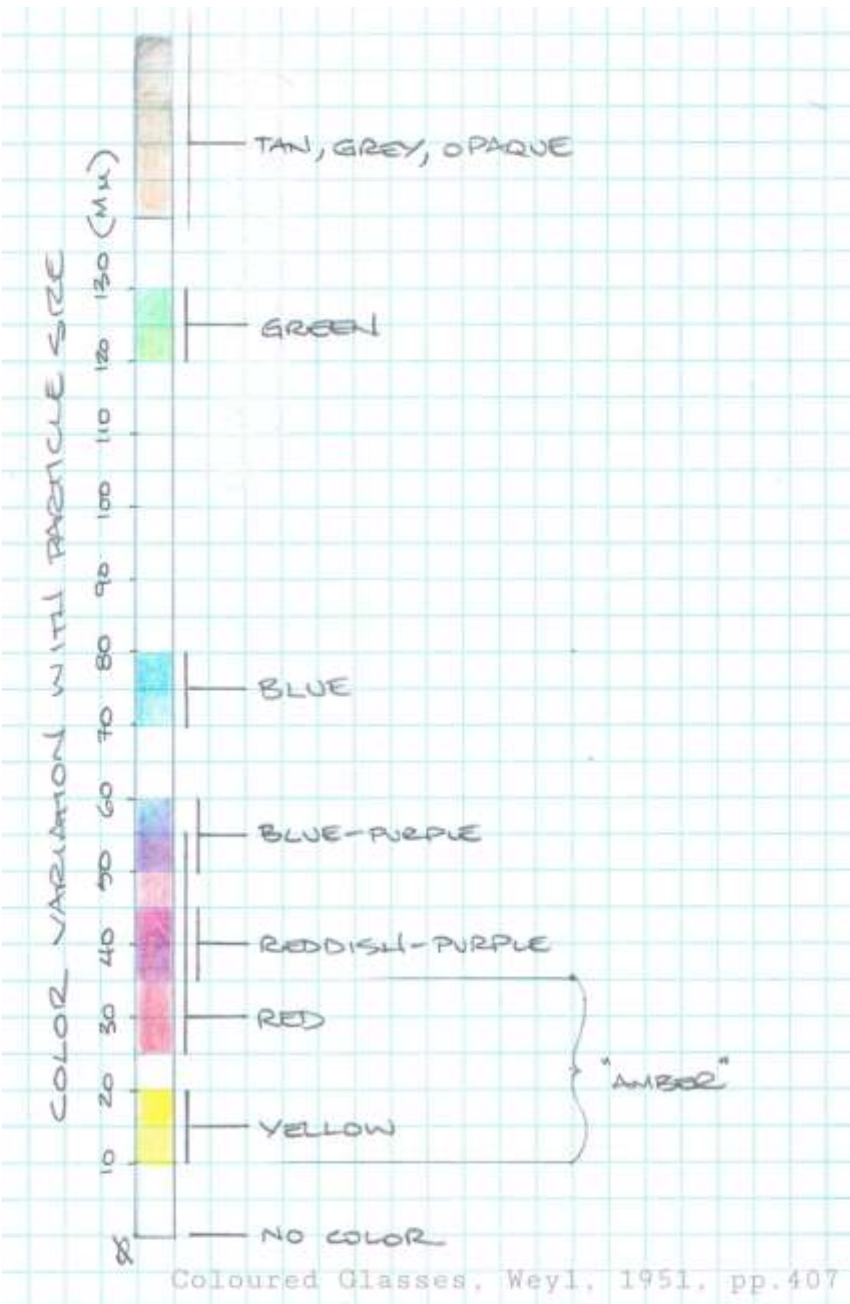
Double Helix Glassworks
Introduction to Striking Glasses

Jed Hannay

Striking Color Theory

The theory of striking colors is that the metals; silver, gold and/or copper are growing crystals (or colloidal chains, depending on which theory you prefer). Silver, or other metals, are dissolved in the glass. When the glass is cooled, then reheated, crystals form inside the glass. As these crystals grow, they cause the glass to transmit and reflect different wavelengths of light.



A. <u>Crystal Growth & Nucleation</u>
Crystal growth begins at a nucleation point. Striking colors can be homogenously or heterogeneously nucleated. In homogenously nucleated glasses, the metal itself forms aggregates that act as nucleation centers. In heterogeneously nucleated glasses, additional materials have been distributed throughout the glass. These materials act as nuclei, "seed" locations for crystal growth. All of our silver striking colors contain additional nucleating agents to affect a clean and complete strike.

B. <u>Crystal size and Color Transmission</u>
As the crystals grow, different colors are transmitted. For silver-based striking colors, the color sequence of lengthening crystals is; clear, yellow, red, red-purple, blue-purple, blue, green[i]. The yellow and red stages usually occur together, resulting in amber or transparent brown. Variations in glass micro-composition, thermal history and heat application throughout the processes creates a polychromatic effect. Overstriking, the development of oversized or disorderly metal crystals tends to produce dull, muddied tones.

Striking Color Process

The process for developing desirable colors from silver striking colors has three distinct steps: Reset, Cool, Strike (RCS)

1. <u>Reset</u>

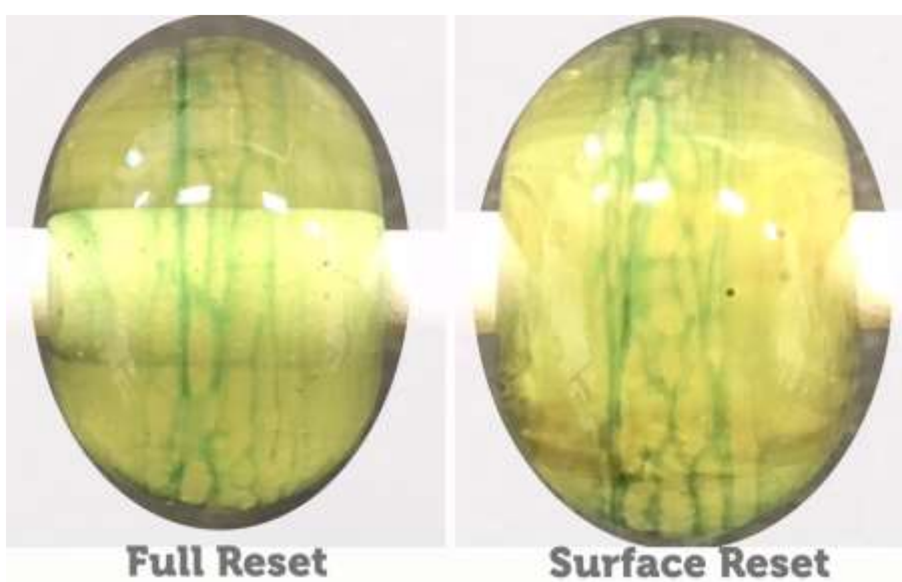
   a. <u>Erasing the Thermal History</u>

During production, the glass has been held at striking temperatures for several hours, resulting in crystal growth. The rods of silver striking glass are often in an "overstruck" state, opaque or misty in appearance. When the glass is heated above a certain temperature, the metals re-dissolve, yielding a clear glass. We refer to this process as the "reset". During the reset, the thermal history of the glass is "erased", allowing us to grow the metal crystals intentionally. In a full reset, the mass of glass would be heated until the entirety of the glass was fully transparent. In practice, we often end up with a partial reset, in which only the surface has been reset.

While the glass can be reset during the gather, with a hot flame heating the end of the rod, it's best to reset in a separate step. Using a separate step eliminates variables and provides a more consistent process and outcome. At the temperatures associated with reset in silver glasses, 104coe glass bases are soft enough to move. This does not necessarily mean that the glass has to be "sloppy hot" to effectively reset the silver. A more judicious application of heat can affect the reset while allowing the viscosity of the glass to remain controllable. Inadequate or incomplete surface reset can result in failure to strike ("it didn't do anything") or undesirable off colors often appearing as dull khaki, opaque, muddy, or earth-toned colors.

   b. <u>Surface or Full Reset</u>

The primary visual cue for determining reset is seeing the glass become transparent. In some colors this will be crystal clear, in others it may be a clean transparent color, tinted by other metals in the glass. Skylla resets to a transparent light green. In a partial or surface reset, the clear layer may only extend to a certain depth, with the core of the bead remaining opaque, swirled, or dark colored. For some applications this surface reset is adequate. Seeing the mandrel clearly through the glass can be a useful visual cue.



2. Cool

The cooling cycle is a critical step in achieving repeatable color outcomes. If the reset glass is not allowed to cool before striking, the process does not yield the desired crystal growth. There is a range of cooling times that produce desirable color outcomes. It takes some amount of experimentation to discover that range. Generally, shorter cooling times will yield lighter pastel colors and longer cooling times will yield darker colors.

- Stuck in Amber Phase = way too short cooling time. Your glass is just being reset over and over.
- Light Pastel Colors = too short cooling time.
- Dark Colors = too much cooling. May look like deep amber with hints of blues and purples.

There are two ways to determine the correct cooling times. The very earliest appearance of light yellow or amber colors can be a useful visual cue that the cooling cycle is complete and the glass is ready to strike. Alternatively, one can use known times (gained through experience) to "count off" the correct cooling time. A clock, stopwatch, metronome, or steady repeatable count can be useful.

Several variables can influence the required cooling time of a striking color.

- Glass composition
- Glass mass (bead size)
- Use of heat sinks; marvers
- Temperature of glass at beginning of cooling cycle
- Thermal insulators; clear encasement

3. Strike

Once the bead has been reset and appropriately cooled, the glass is struck by gently heating in the furthest reaches of a neutral flame. The striking temperature is higher than the cooling temperature, but not as hot as the reset temperature. The glass may be hot enough to move under pressure, but does not flow in response to gravity.

Visual cues for striking include the faint orange glow indicating appropriate temperature as well as direct observation of the glass color. If the color appears too dark, additional strike time can be used. Longer strike times tend to produce lighter, more pastel colors. Excessive strike times can develop more opaque, neutral tones

---

[i] W.A. Weyl, Coloured Glasses, 1951