Introduction to Glaze Composition

Overview: We use glaze in Ceramics as a way of sealing the clay surface making the work more functional for eating and drinking out of. Glaze can also add color to the work and the glaze sheen can make it easier to clean. It is theorized that the first glazed pottery where pieces that may have been washed in sea water and then placed in an open fire. At high temperatures, the sodium of the sea salt will react with the silica in the clay to produce a glaze. NOTE: Do not try this in a regular kiln. The salt vaporizes and will destroy the kiln. There are special salt kilns that are used for this special process.

Glass is made of a glass former (flint aka silica) and a flux (melting agent). If regular glass is melted onto a ceramic form, at some point the glass will release from the clay. Glaze is a glass that is formulated to fit on a ceramic surface. This requires the expansion and contraction coefficient between the two materials to be close if not the same. If the glaze contracts more than the ceramic work, the glaze will craze (crackle). If the glaze contracts less than the ceramic work, the glaze will shiver (peel-off). Glaze is made of silica, alumina and flux. Alumina is a refractory material that helps make the glaze’s expansion and contraction coefficient the same as the ceramic work, thereby aiding the glaze fit to the clay work. The colorants are in the form of metal oxides and are necessary for glaze color development.

The primary sources of silica are:
- Flint also known as silica…it’s quartz ground up into a fine powder.
- Clay- such as all Ball Clays (KT Ball Clay, Kentucky Ball Clay, Tennessee Ball Clay, OM-4 Ball Clay, Grolleg Kaolin, EPK…aka EP Kaolin, Edgar Plastic Kaolin)
- Feldspars- such as Minspar 200 (high sodium spar), Custer Feldspar (potash spar) & G200 Feldspar (potash spar) Note: Spar is an abbreviation for feldspar. Also, Minspar 200 Feldspar is a substitute for Kona F-4 Feldspar which is not available on the West Coast.

The primary sources of alumina are:
- Clay- Cay’s chemical composition is silica, alumina and molecularly bonded water.
- Feldspar- Spars are primarily composed of silica, flux and alumina.
- Note: Some colorants can have a refractory affect in glazes

The primary sources of fluxes are:
- Alkalines which fall into lithium (Li₂O), sodium (Na₂O) and potassium (K₂O) -Potash Spars are Custer Spar and G200 Spar
- Sodium Spars are Minspar 200 Spar & …Kona-F-4 Spar is not available on the west coast.
- Lithium sources are Lithium Carbonate, Lepidolite and Petalite
- Barium, BaO -source is Barium Carbonate
• Boron, B₂O₃
  -source is Gerstely Borate & …Borax has limited applications.
• Calcium, CaO
  -source is Whiting aka Calcium Carbonate, Wollastonite has calcium and silica, also Wood Ash has calcium and other materials in it.
• Magnesium, MgO
  -source is Magnesium Carbonate, Talc is magnesium and silica
• Strontium, SrO
  -source is Strontium Carbonate
• Zinc, ZnO
  -source is Zinc Oxide
• Lead, PbO---is rarely used in Ceramics now due to its toxicity. Lead frits can make lead use much safer in low-fire glazes but they should not be used on the inside of food containers. Do not use lead in our studio. If you are interested in the commercial lead glazes/ fritted lead glazes ask your instructor for permission before bring any in or making any lead based glaze here.

The combination of glass former (silica), the various fluxes (melting agent) and refractory (alumina) determine the melting temperature, also known as temperature of maturity/maturation, surface sheen, colorant response and glaze fit on the ceramic work.

The primary colorants are:
  • Cobalt
  • Copper
  • Iron
  • Manganese...not to be confused with Magnesium, which is a flux.
  • Chrome
  • Titanium
  • Tin

**Glossary:**
*Glass former* is the material that creates a super cool liquid (glass)
*Flux* is a melting agent
*Expansion* is the increase in dimensions of an object. It happens every time a material is heated.
*Contraction* is the decrease in dimensions of an object. It happens every time a material gets cooled.
*Refractory* is a material that resists melting.
*Craze or crazing* is the fine crackle pattern in the glaze after it has been glaze fired
*Shiver or shivering* is when the glaze peels-off the glaze fired work
*Temperature of maturity/maturation* is the temperature at which the glaze is molten and has attained its expected results.