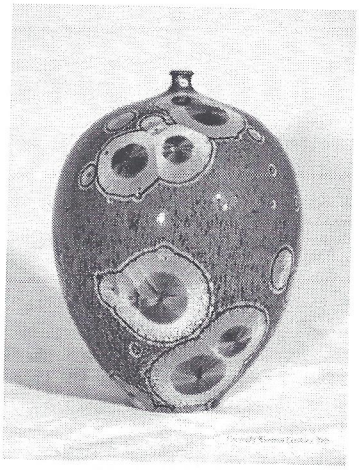
OVERVIEW: What are Crystalline Glazes?

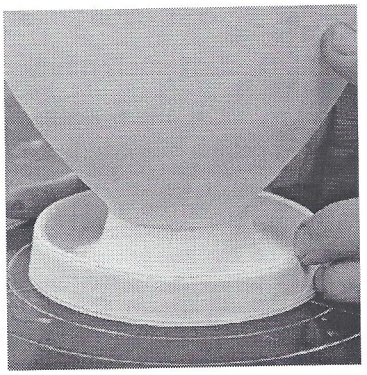
- High-fire, cone 9-10 glazes with ***different formulation*** than most stoneware & porcelain glazes
  - Extremely runny at maturity in kiln – dictates much of the differences in process
  - General formulation -- 50% Frit 3110, 25% Silica, 25% Zinc Oxide
    - Very low in alumina – glazes are very fluid at maturity
    - Zinc-silicates are what make the crystals
    - Compare to typical cone 10 glaze:
      - 40% Feldspar, 30% Silica, 20% Flux, 10% clay
    - Colorants: Iron, Cobalt, Manganese, Rutile, Nickel, Copper
      - Avoid chrome and mason stains – matte out surface



- Crystals grow in surface of glaze ***during cooling***
  - Fire glaze first to proper melting temperature (i.e. 2295-2330 F)
  - Partially cool glaze by 200-300 degrees to the optimal crystal growing temp range (i.e. 1980-2060 F)
  - Hold kiln in this temperature range for several hours to grow crystals
  - Crystals randomly appear where glaze is of the right thickness
    - Too thin = too many crystals (or none)
    - Too thick = syrupy, dark background + little or no crystals
    - Just right = visible, whole crystals floating on background
  - Titanium dioxide helps seed crystals, can be 1-8% of glaze formula (or use rutile or ilmenite)
- Cooling of glazes is controlled – holding points from 30 min up to several hours are programmed into kiln, typically 200-300 degrees from top temperature of glaze
- Fired in electric kilns:
  - Computer controlled programs for accuracy in firing & cooling cycles
  - Oxidation atmosphere produces best, brightest colors
  - Elements need changing after 20-30 firings, or when length of firing increases dramatically
  - Shelves should be kiln-washed / overflowing catch-basins is, unfortunately, a reality with students ☺
- **Not food-safe** – surface too soft, crystals formed with metallic oxides easily leach in mild acids (vinegar, etc.)
  - Lemon wedge testing reveals the background is prone to leaching; crystals are even more prone to leaching by acidic food contact
  - Probably OK for dry foods and hand-washing gently
  - Best for decorative outer surfaces: vases, pitchers, platters, small bowls, trays, mugs, candlesticks

What's different about the throwing/trimming process?

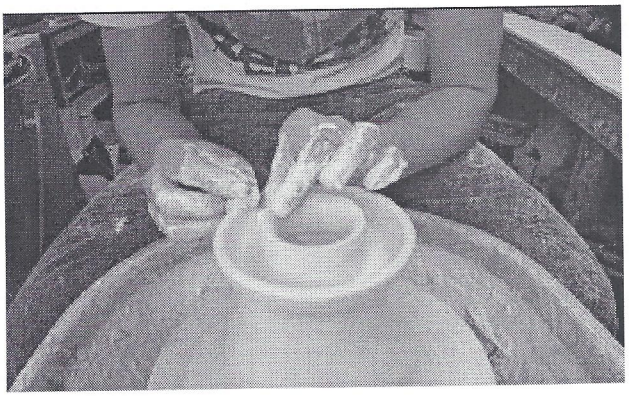
- Clays → porcelain or white stoneware (BMIX); groggy stoneware has issues with pitting in crystal glazes
- Forms → smooth surfaces, no texture, simple lines, elegant forms
- Foot → straight line to foot
- Each piece must have its own, separately-made "catch-basin"
    - A pedestal with inner and outer rims
        - Inner rim supports the pot
        - Outer rim creates a pool (moat) for excess glaze
    - Inner rim matches diameter of foot with a flat-to-flat interface



- ***After piece is trimmed,*** catch-basin (or "glaze catcher") is thrown
    - Measure diameter of foot, and add 6-8% to account for shrinkage between wet clay & leather hard trimmed pots. For example:
        - Trimmed foot is 100mm diameter
        - Inner lip diameter of catch basin will be thrown to 106 to 108mm
    - Must be well made, not too big or tall, but with sufficient "volume" to catch excess glaze
    - **Lip that supports the pot should be exactly the diameter of the foot (perfect fit), or a *little smaller***
        - If lip of pedestal is larger than diameter of your pot's foot – glaze accumulates in crevice making removal of pedestal more difficult, with more damage from chipping up side of pot!

More Glaze-Catcher Math…

LEATHER HARD → Let's suppose you threw a vase last week, and today you trim a foot with diameter of 80 mm. Since the pot is leather-hard (just trimmed!)… you'll throw a catch-basin with pedestal lip diameter 6% bigger than your pot's foot… **(80 mm x 1.06) = 84.8 mm.** Tip: keep vase covered, and when both catch-basin and pot are leather hard – check for fit. If pedestal is too big, trim it down. Catch-basin should be same diameter or slightly smaller than your pot's foot for best results.



BISQUE → Suppose you made a pot last month; it's already bisqued and foot diameter is 90 mm. To make the catcher, add 8% to the diameter of the foot **(90 mm x 1.08) = 97.2 mm**, and use that measurement to throw a catch basin.

Glazing Process Overview

- Application options include dipping, brushing, spraying
- Apply liner glazes a day earlier, or really dry out the pot before apply crystalline glazes outside
- Thickness → apply MUCH thicker than regular glaze, especially toward top of pot
    - Top 1/3 should be thickest (3 coats)
    - Middle 1/3 should be thick (2 coats)
    - Bottom 1/3 should be thick (1-2 coats)
- Crystal glaze is somewhat forgiving… don't worry about brush strokes, drips, unevenness
- Catch-Basin is glued to bottom of pot AFTER pot has been glazed
    - Apply glue to catch-basin liberally
    - Place pot on top of catch-basin; 10-15 minutes for glue to dry and hold pot in place
- Glaze-catcher glue contains Elmer's glue mixed with EPK and Alumina Hydrate
    - Creates a barrier between pot & pedestal
        - Prevents glaze from getting underneath the foot
        - Helps in separation of pieces after glaze firing
- Glaze-catcher glue recipe: 1 cup Elmer's glue, ¼ cup alumina hydrate, ¼ cup EPK, 1 tablespoon water

Post-firing Removal of Catch-Basin

Many pieces will spontaneously separate due to effectiveness of glaze catcher glue. For all others….

- Place pot with pedestal on the center of banding wheel or pottery wheel
- Spin or rotate piece slowly
- Aim torch flame at connection between pot & pedestal (aiming lower is better…)
- Heat for 30-60 seconds and listen for the "tink-tink-tink" sound
- Stop wheel, and tap firmly on pedestal outer lip while holding pot just up above the wheel head
    - If piece does not separate… repeat steps above
- Carefully set pot aside, and remove HOT pedestal with gloves – it's HOT since it's just been heated with the torch. Place on floor or other inflammable surface.
- Use grinding disk to smooth bottom of pot
    - Use lots of water for lubrication, extend life of grinding disk
    - Grind bottom flat first, then hold at angle to smooth/bevel the foot rim
- Discard used pedestals in garbage (once cooled)

Glaze Recipes*

Nickel		**WHITE**		**TEAL**	
blue on amber		***white on white***		***light blue on light green***	
Frit 3110	51	Frit 3110	49	Frit 3110	50
Zinc Ox	25	Zinc Ox	24.5	Zinc Ox	26
Silica	24.5	Silica	18	Silica	25
Lithium Carb	0.4	EPK	1.5	Copper Carb	1
Veegum T	1	Titanium Diox	8	Cobalt Carb	0.5
Nickel Ox	2	Bentonite	2	Titanium Diox	6
Iron Ox	1.5	Lithium Carb	0.7	Lith Carb	1.3
Manganese Diox	1	Veegum T	0.75	Veegum T	0.75

Firing & Cooling Schedule

Ramp/Hold Sequence for Skutt KM-1227
at Higher Fire (max 2350, cone 8)

Segment	Rate	Target	Hold	
1	250/hr	300	15	
2	300/hr	1150	0	
3	400/hr	2264	45	*PEAK*
4	9999	1990	30	COOLING...
5	9999	2035	1.30	
6	9999	1880	30	
7	9999	1990	1.30	
8	9999	1865	45	

References / Links

The Art of Crystalline Glazing: Basic Techniques by Jon Price & Leroy Price

Phil Hamling's web page -- http://puttgarden.com/crystal/2007/Page.html

Fara Shimbo's "Bory I" glaze & schedule / www.digitalfire.com web site

*Greg Beckman / Moonlit Method Ceramics

Crystalline Glaze Forum -- http://crystalglaze.freeforums.net

Diamond Core Tools (CI Products / grinding disks) www.buyciproducts.com/8-diamond-grinding-discs/