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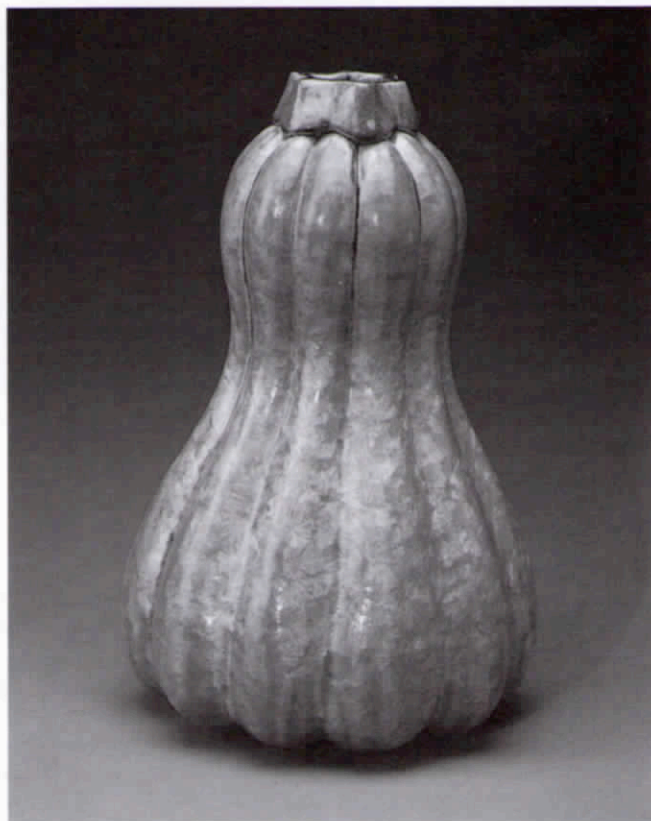
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Kate Malone • José Vermeersch • Maggie Angus Berkowitz
Mary Wondrausch • David Frith • Katharine West • Palissy

Crystalline Alchemy

Kate Malone was stimulated to start investigating crystalline glazes whilst browsing through Emmanuel Cooper's book *Cooper's Book of Glaze Recipes* (Batsford), reading the sentence 'a honey glaze that forms turquoise crystals in areas' (no. 247). Samples of base ingredients were ordered, mixed up, applied to an enclosed hollow pebble shaped test, and, on firing revealed the most exquisite small crystals. Here she explains her obsession. Photographs by Peter Chatterton, Brian Nash, Steve Speller.



Kate Malone – Lady Gourd, vase, h.16". The movement of glaze (with iron oxide) gave an unexpected pinkish bloom at the top

The crystalline glaze was the result of the enclosed form of the pebble, and by coincidence, a densely packed kiln, which had ensured a slow cooling curve, even though I had not programmed a controlled cooling cycle into the controller, (a controlled, slow cool is usual for crystalline glazes). Four years on I have this test pebble as a prized possession. It is important to apply test glazes into a piece of bisc that is nice to have in itself, it can make the reading of the test much easier, any old scrap of clay can make a good test result seem poor. When I plan a series of tests I design the clay test piece to give as much information as is possible i.e. in horizontal

pools, on a vertical and on smooth and modelled surfaces.

Previously I had been researching multiple fired earthenware glazes, and still use them on certain pieces, but with them I do feel very much 'in control'. The magic and mystery that ceramics holds, when you really do not know what a test will bring, was rekindled by the first crystalline recipe. I planned a series of tests around the Cooper glaze, (named ECAF tests in my files after Emmanuel Cooper and the main ingredient, alkaline frit). Tests were devised similar to those for earthenware; that is taking a base clear glaze and achieving different coloured glazes by adding various pigments: nickel oxide, copper carbonate, cobalt carbonate, red iron oxide, rutile light, manganese dioxide, vanadium pentoxide, and various high firing glaze stains. I used these pigments singly, and in blends. These 100 or so ECAF tests are part of the range of glazes I now use.

The ECAFs are essentially stoneware, transparent, tinted glazes that form crystals of their own colours, crystals that you really only notice on close inspection, like soft 'pom-poms' or snowflakes (except for the nickel oxide that gives turquoise crystals.)

My next step was to find a more dramatic crystalline base glaze in order to experiment with whole blanket areas of crystals that I had occasionally seen in books.

Derek Clarkson's superb article (see CR 137) encouraged me to continue testing. His generosity of practical tips and research are exemplary. The more we share our results the more we advance the field, and our ceramic heritage develops to everyone's advantage. His article is essential for anyone who wants to try crystal growing.

The London Arts Board awarded me a grant for further research – £1000 to enable me to put aside studio time and pay for materials and firings specifically for testing. Fate also sent me Barbara Norris, a student from Medway BA Ceramics course, on a summer student placement. She was perfect as a glaze testing assistant, everything was worked out with the most thorough care. Together we carried out some 200 tests using some of Derek's base glazes from *Ceramic Review* as another starting point.

These DCE and DCG glazes are more opaque than the ECAFs, producing 'blankets' of crystals in various colours according to the pigments added to the base glazes.

Currently I draw from the ECAFs and DCEs, the most successful are painted onto pots with big 'mop' brushes in thick, thick layers, that crack and crumble when raw. In the kiln they POUR off the pot surfaces at top temperature 1260°-1280°C. Specially made trays collect the pools that gather below. Props are also bespoke; often pieces have to be chiselled from trays, props, shelves, and pot bases then ground with an angle grinder, drill grinders and diamond pads by my partner Graham. A scarred base is often finished with gold leaf. This finishing is a traumatic process. I feel I could improve on the stiling of the work. But with the



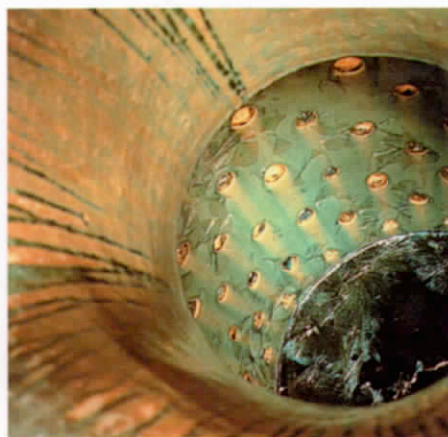
Prince Pine Cone Jug (h.9") – Detail, ECAF 1 at top, DCE 50 below



Juicy Fruit (dia.24") – Detail of Interior, DCE 148 with ECAF 33 over the top



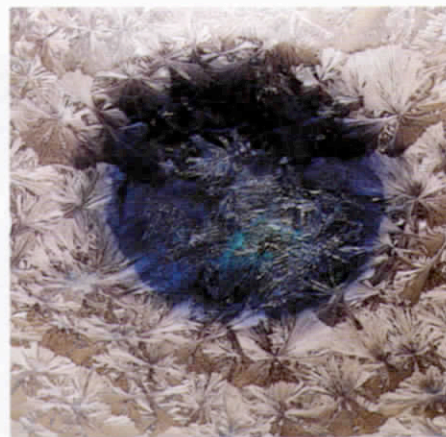
Lady Pumpkin Jug (h.16") – Detail of interior with bee, DCE 50



Queen Pineapple (h.42") – Detail of Interior, DCEs and ECAF 1



Test piece – Detail, DCE 91. The vanadium created dramatic green and yellow crystals



Eye, Fruit of Your Dreams (16" dia.) – Detail of 'pupil', DCE 1

larger pieces the movement in the kiln whilst firing, the shrinkage and rebalance of ware due to the flow of glaze at top temperature, is considerable. The ware therefore has to have a lot of shelf contact, and glazes weld them down. Opening the 36 cubic foot kiln sometimes packed with months of work stacked on shelves three to four foot up in the air is a 'breath holding' moment. The denser the pack, the more exciting the crystals.

As with my earthenware glaze application several different glazes are often painted onto each piece on different areas, these merge and blend with the downward movement of glaze in the kiln, forming rivers in valleys and pools on horizontal surfaces and in the base of the pots, and a myriad of crystals in the moving and mixing process. A record is kept of each piece with a date, a drawing and glaze numbers noted.

Sometimes when crystalline glazes are used, the pots seem to be simply carriers for this 'special effect' – crystals being the primary attention grabber. My aim is to create ceramics where the form and crystalline surface are in harmony and balance.

I enjoy the fact that crystal glazes are rather kitsch, reminding me of '70s discos and flock wallpaper. At the

same time they have a delicate fragility like icy 'jack frost' on a window pane, or velvet butterfly wings that could be rubbed away with a stroke of the hand, which of course they cannot be. I have been told that some of the crystals keep on growing when the piece is out of the kiln – the small brown iron crystals, perhaps like rust spots, get larger over years expanding in the superliquid of the glaze. I have measured some and intend to keep a record to see if I am having my leg pulled.

Currently, my work is based on nature, the fruits of the earth and the imagination. It is inspired by my wonder at the magic of watching seeds and plants grow and with the richness of experience, colour and form nature gives. With crystalline glazes the magic is replicated when the crystals actually seed and grow in the kiln. In a way the kiln work and glaze recipe is simulating volcanic activity to grow crystals as they once grew in the earth's crust.

My basic understanding of crystal growth is that oversaturation of glaze ingredients produces the crystals – in this case zinc and silica. Zinc crystals are thrown out from the matrix in much the same way as when you over boil sugar (and get sugar crystals) when cooking jam or fudge – the sugar crystallises out from the water. With the glaze, the



Kate Malone – Juicy Fruit (24" dia.), mixed DCE and ECAF glazes

Sliced Fruit of Your Dreams – Detail of base, mixed ECAFs over Ceramatech's white dolomite 'Hermaline' glaze



Sliced Fruit of Your Dreams (dia.18", h. 22") ECAF 1 on flat rim, ECAF 33 inside



long soak of the kiln between about 1093°C and 1040°C (see firing cycle example) provides an over cooking of the glaze, therefore over saturating the glaze solutions and growing crystals. The size, shape and colour of crystals then depends on the length and programme of that kiln soak and the colouring pigments used.

Technical Notes

Clay Body

I use T Material clay and bisc fire to 1000°C. This fires quite white to provide a bright base under the glazes. It is also versatile for both earthenware and stoneware temperatures, and seems to tolerate several glaze firings and hold the most complex of shapes steady.

Firing Programme

A typical programme for a 1260°C crystalline firing. (all degrees centigrade).

60° per hour to 180°

120° per hour to 1260°

Close bungs at 400°

Cool as fast as possible between 1260° and 1093° (i.e. open bungs)

Close bungs at 1093°

Hold at 1093° for 100 minutes

Hold at 1083° for 110 minutes

Hold at 1073° for 40 minutes

Hold at 1069° for 20 minutes

Rise again to 1093° for 30 minutes

Finish programme.

The number 1093° is simply a number I chose and use for good luck. I think the crystal growth happens between 1090°ish and 1040°ish.

If you vary the soak period the crystals are different sizes and shapes.

If you rise up after a soak 'halos' can form.

Derek Clarkson mentioned that an American soaked a kiln for weeks to grow crystals. Or did I dream this?

On the large pieces – four foot high pots, or three foot wide dishes – it seems that each crystal grows larger. On a giant wine cooler last year some were 4" across.

Glaze Recipes

Glazes are mixed using barrier cream and gloves on hands and mask on face.

Glazes are mixed thickly to ease application of thick layers and sieved through a 120 sieve.

The ECAF base

High alkaline frit	58
Zinc oxide	23
Flint	17
Bentonite	2

The first test I ever mixed, a honey glaze with turquoise crystals was ECAF2: Base ECAF mentioned above plus 1.5% nickel oxide black.

Others that are essentially a clear tinted glaze that grows crystals of the same colour:

ECAF 1	Base plus 2% copper carbonate. Turquoise.
ECAF12	Base plus 3.2% copper carbonate. Green.
ECAF33	Base plus 6% red iron oxide. Golden honey.
ECAF22	Base plus 2% copper carbonate and 0.4% cobalt carbonate.
ECAF37	Base plus 3% red iron oxide and 4% copper carbonate. Honey green.
ECAF61	Base plus 0.4% cobalt carbonate. Soft blue.

The DCE base

Ferro frit 3110	44
Zinc oxide	26.4
Flint	20.4
Titanium dioxide	7.6
China clay	1.2

This is a blanket crystal glaze.

It is very different when thin or thick.

A sample of additions to this base are:

DCE5	Base plus 2% copper carbonate. Soft green.
DCE6	Base plus 3% red iron oxide. Golden Honey crystals.
DCE1	Base plus 0.4% cobalt carbonate 1.2% manganese dioxide. Soft grey blue.
DCE50	Base plus 2% cobalt carbonate 2% manganese dioxide. Stronger blue.
DCE 51	Base plus 2% cobalt carbonate 6% manganese dioxide. Mystery glaze.
DCE 91	Base plus 3.2% vanadium pentoxide 1.2% nickel oxide. Black.
DCE 148	Base plus 2% Ceramatch High Firing Colour CT 4380. Whitish yellow.



Kate Malone – Mr and Mrs Gourd Jugs, (h. 14 and 16")

This article is a reply and thank you to those who wrote to me after my letter appeared on the letters page of *Ceramic Review*. I have not yet used any recipes sent, but have them on file for my next set of tests, I will reply if a base offers new areas. Anyone with other tests to share please write to me or *Ceramic Review*.

Kate Malone's exhibition 'Fruits of the Imagination' is at Dover Street Gallery, 13 Dover Street, London W1 March 4–27 1997.