

Pyrophilite or Pyrax (200 mesh)

Similar to talc. Reduces thermal expansion in clay bodies. Can use up to 20% in formula.

SiO ₂	75.20%
Al ₂ O ₃	20.40
Fe ₂ O ₃ .....	.10
CaO .....	.02
Na ₂ O .....	.03

Redart (200 mesh)

A good, clean, red low-fire clay from the Cedar Heights Co. in S.E. Ohio. Not very plastic. The addition of bentonite is suggested in a clay body. Makes a very good low-fire slip.

SiO ₂	64.27%
Al ₂ O ₃	16.41
Fe ₂ O ₃	7.04
TiO ₂	1.06
CaO .....	.23
MgO	1.55
K ₂ O	4.07
Na ₂ O .....	.40
P ₂ O ₅ .....	.17
L.O.I.	4.78

Roseville Stoneware (200 mesh)

Best if used in the cone 6-8 range but can be used in a cone 10 body. Darker than Goldart and not as high in sulphur.

SiO ₂	60.87%
Al ₂ O ₃	23.41
Fe ₂ O ₃	2.13
TiO ₂	1.65
MgO .....	.21
CaO .....	.37
Na ₂ O .....	.31
K ₂ O	2.51
S .....	.03
L.O.I.	8.51
PCE .....	.Cone 23

Rutile (TiO₂, FeO) Powder

Impure form of titanium dioxide. Contains iron, chromium and vanadium oxides. Creates ivory, yellows, tans. Heavy percentages in glaze breaks up colors and gives matte and crystal surfaces.

Salt Lick (200 mesh)

A stoneware clay mined directly below Goldart. The sandy texture makes it less plastic, with less sulphur than Goldart.

SiO ₂	62.00%
Al ₂ O ₃	25.00
Fe ₂ O ₃	1.60
TiO ₂	1.50
MgO .....	.50
CaO .....	.20
Na ₂ O .....	.10
K ₂ O	2.30
L.O.I.	6.80
PCE	23.00

Sapphire (200 mesh) or #6 Tile Clay (200 mesh)

These two clays are virtually identical. Very plastic, clean and white. Both mines are owned by Imerys.

SiO ₂	46.90%
Al ₂ O ₃	38.20
Fe ₂ O ₃ .....	.35
TiO ₂	1.42
CaO .....	.43
MgO .....	.58
Na ₂ O .....	.04
L.O.I.	13.90
PCE .....	.Cone 35

Silica Sand (60 mesh)

A much coarser grind of Silica used with or as an inexpensive substitute of grog. Softens at cone 9.

SiO ₂	100.00%
------------------------	---------

Silicon Carbide FFF (SiC)

A very fine form of silicon carbonate. Used in glazes with copper carbonate and tin oxide to produce reds.

Toxic if inhaled.

Sodium Bicarbonate (NaHCO₃)

A water soluble flux agent. Combined with soda ash, it is a good, non-toxic substitute for rock salt in salt firing.

Sodium Carbonate (Na₂CO₃)

Soda Ash. Used as a deflocculant in casting slips, helps make Egyptian paste and small amounts in clay bodies gives increased strength and reduced shrinkage.

Spanish Iron Oxide

Fires dark brown to black. A semi-refractory colorant applied as surface decoration under or over a glaze.

Spodumene (200 mesh)

A feldspar high in lithium that reduces thermal expansion in clay bodies and brightens blue glazes.

SiO ₂	60.98%
Al ₂ O ₃	27.87
Fe ₂ O ₃ .....	.45
CaO	1.50
MgO .....	.61
K ₂ O .....	.51
Na ₂ O .....	.22
Li ₂ O	6.55

Strontium Carbonate (SrCO₃)

Used in clay bodies for less pinholing and blistering in glazes. Improves hardness and lowers solubility in glazes. Extends glaze firing range.

Superpax ZrO₄, SiO₂

Zirconium silicate opacifier. 92-94.5%
Used in glazes as an opacifier and to control texture, color stability and craze resistance. Smaller particle size than Zircopax for better water dispersion.

T-7 Kaolin (200 mesh)

A good, white kaolin used in basic glaze and slip formulas.

SiO ₂	44.72%
Al ₂ O ₃	39.20
Fe ₂ O ₃ .....	.36
TiO ₂	1.76
P ₂ O ₅ .....	.10
CaO .....	.22
MgO .....	.01
MnO .....	.01
SO ₃ .....	.02
Na ₂ O .....	.01
L.O.I.	13.55
PCE .....	.Cone 35

Talc Nyalta 100 HR (200 mesh)

A high resistant talc requiring less sodium silicate in slips. Mainly used in low-fire slips, earthenware bodies and raku bodies. Increases resistance to thermal shock. Produced in upstate New York.

SiO ₂	55.55%
Al ₂ O ₃ .....	.30
Fe ₂ O ₃ .....	.20
CaO	8.00
MgO	30.10
Na ₂ O .....	.30
L.O.I.	3.46

Tin Oxide SnO₂

The best and most expensive opacifier. Produces even, opaque glazes. Normal usage is from 2-10%. Twice the strength as Superpax and Zircopax.

Titanium Dioxide (TiO₂)

An opacifier which promotes matte to semi-matte glazes. Produces crystal effect at 6-15%. Impure forms of titanium are rutile and ilmenite.

Ultrox

A very stable, reliable opacifier widely used in large commercial potteries. Not as potent as Tin Oxide but stronger than Superpax.

Volcanic Ash (Pumice)

Used as a flux in glazes and added to earthenware clay bodies for aiding in thermal shock resistance during pit and raku firings.

Whiting (CaCO₃)

Calcium Carbonate. The most common form of calcium ceramics. Used as a flux in glazes and clay bodies and for durability and hardness to glazes.

Wollastonite (CaSiO₃)

A natural source of calcium silicate used in glazes and clay bodies. Replaces silica and whiting.

XX Sagger (200 mesh)

A good, white ball clay from K-T Clays in Kentucky. Lower in iron than OM4. Good plasticity.

SiO ₂	56.70%
Al ₂ O ₃	29.20
Fe ₂ O ₃ .....	.07
TiO ₂	1.70
CaO .....	.50
MgO .....	.30
K ₂ O .....	.90
Na ₂ O .....	.30
L.O.I.	9.80
PCE .....	.Cone 32

Yellow Ochre (2FeO₃, 3H₂O)

A weaker form of yellow iron oxide due to the high content of clay.

Zinc Oxide (ZnO)

A flux which causes more vibrant colors, a glossier glaze finish, increases maturing temperature and reduces crazing. 18-28% zinc glazes produce crystals when cooled slowly.

Zircopax Plus ZrO₂, SiO₂

Zirconium silicate opacifier. 94-96%.
Used much the same way as Superpax, but has larger particle size. A little stronger and more economical to use than regular Zircopax.

***PCE stands for Pyrometric Cone Equivalent. Determines how refractory a material is. It is fired with cones and when material softens, the number of the cone melting at that point is the PCE.**

***L.O.I. stands for Loss on Ignition. Summarizes the components within a raw material that burn away and are lost as gases.**

RAW MATERIALS GLOSSARY

Goldart (200 mesh)

A very plastic air-floated secondary clay from Cedar Heights. Can be used as a ball clay or fireclay. Fairly high in sulfur content.

SiO ₂	57.33%
Al ₂ O ₃	28.50
Fe ₂ O ₃	1.23
TiO ₂	1.96
CaO .....	.08
MgO .....	.22
K ₂ O	1.18
Na ₂ O	1.16
SO ₃ .....	.24
L.O.I.	10.03
PCE .....	.Cone 29

Gold Label (200 mesh)

Produced by Old Hickory Clays, this ball clay is similar to Foundry Hill Cream. Extremely plastic.

SiO ₂	61.69%
Al ₂ O ₃	22.09
Fe ₂ O ₃	1.35
TiO ₂	1.16
CaO .....	.13
MgO .....	.42
K ₂ O	1.17
Na ₂ O .....	.10
L.O.I.	9.21

Grog 20 coarse

Grog 35 medium

Grog 50 fine

Ground and screened refractories, in our case ground up pottery. Used to open up clay bodies, such as stonewares and raku. Strengthens, reduces shrinkage and adds texture.

Grolleg China Clay (200 mesh)

Imported from England. One of the whitest kaolins available. Not very plastic.

SiO ₂	48.00%
Al ₂ O ₃	37.00
Fe ₂ O ₃ .....	.07
TiO ₂ .....	.03
CaO .....	.10
MgO .....	.30
K ₂ O	1.90
Na ₂ O .....	.10
L.O.I.	12.10
PCE .....	.Cone 35

Hawthorn Bond (35 & 50 mesh)

A Missouri fireclay with similar properties to A.P. Green but less expensive. Fires light buff at Cone 10.

SiO ₂	55.10%
Al ₂ O ₃	39.11
Fe ₂ O ₃	1.02
TiO ₂	2.08
CaO .....	.15
MgO .....	.85
P ₂ O ₅ .....	.09
Na ₂ O .....	.24
K ₂ O	1.24
SO ₃ .....	.03
L.O.I.	11.32
PCE .....	.Cone 31

Ilmenite (Fe₂O₃, TiO₂)

Granular.

An opaque mineral used to produce speckled effects in glazes and clay bodies. Granular creates more noticeable specks.

Iron Chromate (FeCrO₄)

Used for darker colors such as browns and brown-reds.

Toxic if inhaled.

Iron Oxide Black (Fe₃O₄)

Ferrous Oxide. Not as popular as red iron oxide due to its minimal color range.

Iron Oxide Red (Fe₂O₃)

Ferric Oxide. The most popular form of iron oxide. Colors range from yellow, tan, red, brown and black. Used in iron saturate glazes such as tenmouku, aventurine and oilspot.

Toxic in large amounts if inhaled.

Iron Oxide Yellow (Fe₂O₃)

A stronger version of yellow ochre but weaker than red iron oxide due to its hydrated form and high clay content.

Kentucky Stone (200 mesh)

A good plastic ball clay with natural sands from Kentucky. Less sulphur than Goldart.

SiO ₂	66.40%
Al ₂ O ₃	21.40
TiO ₂	1.30
Fe ₂ O ₃	1.60
CaO .....	.20
MgO .....	.50
K ₂ O	1.30
Na ₂ O .....	.20
So ₃ .....	.16
C .....	.34
PCE	24.00

Kona F-4 (200 mesh) or

Minspar 4 (200 mesh)

These interchangeable feldspars are used wherever a soda spar is called for. Both are mined in North Carolina. 4.8% potash, 6.9% soda.

SiO ₂	66.76%
Al ₂ O ₃	19.70
Fe ₂ O ₃ .....	.04
CaO	1.80
K ₂ O	4.80
Na ₂ O	6.90

Kyanite 48 (48 mesh) and

Kyanite 100 (100 mesh)

An alumina silicate mineral that can be used instead of and with grog to strengthen clay bodies. Helps with thermal shock in raku bodies.

SiO ₂	54.80%
Al ₂ O ₃	39.40
Fe ₂ O ₃	1.50
KNaO	2.00
TiO ₂	1.50
CaO .....	.50
MgO .....	.30

Lithium Carbonate (Li₂CO₃)

In glazes, reduces thermal expansion, increases brightness of colors and increases firing range.

Magnesium Carbonate Light (MgCO₃)

Produces high-fire smooth, buttery surfaces in glazes along with opacity, strength, hardness and less shrinkage.

Manganese Dioxide (MnO₂) Powder or Granular.

Colors obtained from manganese are purple, brown, black, amethyst, reddish violet. More than 5% in a clay body will make it bloat at high fire. **Toxic if inhaled or ingested.**

Molochite -30 (30 mesh) and

Molochite -200 (200 mesh)

A white grog made from ground up high-fired porcelain pottery or calcined kaolins. Used in porcelains and white clay bodies.

SiO ₂	52.50%
Al ₂ O ₃	43.00
Fe ₂ O ₃	1.00
TiO ₂ .....	.08
CaO .....	.10
MgO .....	.10
K ₂ O	1.50
Na ₂ O .....	.10

Mullite 35 (35 mesh) and

Mullite 48 (48 mesh)

Calcined Kyanite. Used in clay bodies, kiln shelves, posts and high-fire porcelains. Mined in Virginia.

SiO ₂	46.73
Al ₂ O ₃	54.17
Fe ₂ O ₃ .....	.94
KNaO .....	.42
TiO ₂ .....	.67
CaO .....	.03
MgO .....	.01

Nepheline Syenite (270 mesh)

A lower fluxing form of a soda spar. 5% potash, 10.2% soda. Mined in Ontario, Canada.

SiO ₂	60.24%
Al ₂ O ₃	24.05
Fe ₂ O ₃ .....	.06
CaO .....	.15
MgO .....	.02
K ₂ O	5.00
Na ₂ O	10.20

Nickel Carbonate Green (Ni₂CO₃)

Weaker form of nickel. Easier to mix.

Fumes are toxic.

Nickel Oxide Black (Ni₂O₃)

Produces browns, grays, blues, yellows and greens.

Maximum amount in glazes is about 3%.

Toxic in raw form.

OM4 Ball Clay (200 mesh)

The most common midwest ball clay, mined in Kentucky. Very plastic and is used wherever a ball clay is called for in glaze or clay body.

SiO ₂	55.60%
Al ₂ O ₃	28.60
Fe ₂ O ₃	1.00
TiO ₂	1.80
CaO .....	.01
MgO .....	.40
K ₂ O	1.10
Na ₂ O	1.10
L.O.I.	11.40
PCE .....	.Cone 32

Petalite (U₂O, Al₂O₃, 8SiO₂)

Lithium feldspar used in medium to high temperature glazes and clay bodies. Aids in producing excellent heat shock resistant clay bodies.

Potassium Carbonate (K₂CO₃)

Pearl Ash. Medium to high temperature flux in clay bodies and glazes. Produces yellow-green glazes with copper.

*PCE see page 49 for definition

Albany

A synthetic albany slip manufactured by Great Lakes Clay based on the chemical make-up of the original Albany Slip.

Alumina Hydrate (Al₂O₃ 3H₂O)

The preferred source of Alumina. Calcined Aluminum. Helps with glaze adhesion and crazing. Widely used in salt kilns and as a kiln wash because of its high refractory properties.

Amorphous Silica (200 mesh)

Used in glazes for its anti-crazing properties. Unlike normal silicas, amorphous silica does not undergo radical changes during firing (contraction and expansion), so there is no quartz inversion.

Barium Carbonate (BaCO₃)

Used as a flux in glazes creating matte surfaces. Using .5-2% barium in red clay bodies prevents scumming and neutralizes sulfur. **Dust is Toxic.**

Bentonite (200 & 325 mesh)

A highly plastic volcanic ash clay. Used in clay bodies to aid in plasticity and in glazes as a suspender. Use 200 mesh in clay bodies and 325 mesh in glazes. 1-2%.

SiO ₂	63.02%
Al ₂ O ₃	21.08
Fe ₂ O ₃	3.25
FeO .....	.35
MgO	2.67
Na ₂ O	2.57
K ₂ O	2.57
CaO .....	.65
H ₂	5.64

Bone Ash (3CaO P₂O₅)

Tri-Calcium Phosphate. A synthetic bone ash. A flux and opacifier in glazes. Can use up to 50% in white clay bodies to make bone china.

Boric Acid (H₃Bo₃)

Replaces lead as a low-fire flux. Increases gloss in glazes and smoothes fired surface. **Toxic in raw form.**

Borax (Na₂O, 2B₂O₃, 10H₂O)

Also replaces lead as a low-fire flux. Like Boric Acid, borax is water soluble. **Toxic in raw form.**

Burnt Umber

A calcined combination of iron and manganese. Used as a colorant for clay bodies and slips.

Cedar Heights 50 (50 mesh)

A strong, fairly plastic fireclay from the Cedar Heights Co. Cleaner than A.P. Green and Hawthorn Bond. Low in sulfur.

SiO ₂	63.70%
Al ₂ O ₃	21.13
Fe ₂ O ₃	1.62
CaO .....	.55
MgO .....	.11
TiO ₂ .....	.30
P ₂ O ₅ .....	.07
Na ₂ O .....	.47
L.O.I.	8.24
PCE .....	.Cone 29

C&C Ball Clay (200 mesh)

A good plastic, strong ball clay from Tennessee. Lighter in color than OM4.

SiO ₂	55.60%
Al ₂ O ₃	28.38
Fe ₂ O ₃ .....	.98
MnO .....	.02
TiO ₂	1.64
CaO .....	.37
MgO .....	.30
Na ₂ O	
K ₂ O .....	.40
So ₃ .....	.03
P ₂ O ₅ .....	.15
L.O.I.	12.30
PCE .....	.Cone 33

Chromium Oxide (Cr₂O₃)

Used in glazes for its green hues. The addition of tin oxide produces chrome-tin pinks. Over 2% in a glaze makes the color opaque. **Dust is Toxic.**

Cobalt Carbonate (CoCO₃)

Lavender color in dry form, as little as .2% will produce distinctive blues. Gives the Pennsylvania Dutch blue look.

Cobalt Oxide (CoO)

Black color in dry state. Coarser mesh than the carbonate, will give a speckle effect in glaze if not screened with a high mesh sieve.

Copper Carbonate (CuCO₃)

Most widely used form of copper in ceramics. A fluffy, light green powder that is easily mixed. Turquoise colors in oxidation and red lusters in reduction atmosphere.

Copper Oxide Black (CuO)

Oldest glaze colorant. Used for greens and blues in oxidation. At cone 8 reduction, copper can jump from one pot to another. Reduction can produce reds. **Toxic in raw form and should not be used on dishes or drinking vessels.**

Copper Oxide Red (Cu₂O)

Made by heat treating black copper oxide. Insoluble in water. Particles take days to wet and mix. Red glazes are achieved in reduction firing.

Copper Sulfate (CuSO₄, 5H₂O)

Used in raku, pit and sagger firing to create copper lusters and rainbow effects. **Poisonous.**

Cornwall Stone (200 mesh)

A feldspar from the Cornwall district in England. Used in clay bodies, glazes and engobes.

SiO ₂	71.10%
Al ₂ O ₃	16.82
Fe ₂ O ₃ .....	.16
CaO	1.60
MgO .....	.05
K ₂ O	6.57
Na ₂ O	2.29
CaF ₂ .....	.50

Cryolite (Na₃AlF₆)

Sodium aluminum fluoride. Produces craters in glazes when the fluorine gases escape during firing.

Custer Feldspar (200 mesh)

The most widely used potash feldspar in both clay and glazes. 10.4% potash, 3% soda. Mined in Custer, SD.

SiO ₂	68.50%
Al ₂ O ₃	17.50
Fe ₂ O ₃ .....	.08
CaO .....	.03
MgO	Trace
Na ₂ O	3.00
K ₂ O	10.40
L.O.I. ....	.30

Dolomite [CaMg, (CO₃)₂]

56% calcium carbonate and 44% magnesium carbonate. Used as a high temperature flux and also as a matting agent.

EPK (200 mesh)

A good, plastic kaolin that can be used wherever a formula calls for no specific kaolin.

SiO ₂	46.50%
Al ₂ O ₃	37.62
Fe ₂ O ₃ .....	.51
TiO ₂ .....	.36
CaO .....	.25
MgO .....	.16
K ₂ O .....	.40
Na ₂ O .....	.02
F ₂ .....	.08
So ₃ .....	.21
P ₂ O ₅ .....	.19
V ₂ O ₅ .....	.0001
L.O.I.	14.00
PCE .....	.Cone 35

Flint 200 (200 mesh) and

Flint 300 (325 mesh)

Also known as Silica Flour. The most important item in ceramics. Increases thermal expansion in clay bodies and decreases thermal expansion in glazes. Higher content in glazes increases melting point. **Toxic if inhaled.**

SiO ₂	100%
------------------------	------

Fluorspar (CaF₂)

A whitening substitute for more fusible glazes. Can be used porcelain for better translucency. **Toxic in raw form.**

Foundry Hill Creme (200 mesh)

A good plastic ball clay that was out of production for awhile. Not as plastic as Gold Label. From the H.C. Spin Co.

SiO ₂	66.21%
Al ₂ O ₃	20.48
K ₂ O .....	.67
Na ₂ O .....	.55
L.O.I.	12.09

Greatley Borate™

Manufactured by Great Lakes Clay, this is a direct substitute for Gerstley Borate, which is no longer available. Comprised of selected materials which, when combined, closely resemble the chemical make-up of Gerstley. Commonly used in raku glazes.

Gloxam LL (200 mesh)

A calcined kaolin for use when glaze fit is a problem. Reduces shrinkage in clay bodies or glazes.

SiO ₂	53.80%
Al ₂ O ₃	44.40
L.O.I. ....	.80

*PCE see page 49 for definition