

Appalachian Center for Craft - Clay Studio

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Glossary of Ceramics Terminology

NOTE: For identification and definitions of ceramic raw materials, see separate glossary of ceramics materials.

ABSORPTION: The capacity of fired clay to absorb water. Measuring absorption serves as a gauge of *vitrification*.

ACIDS: In clay and glaze chemistry, the *glass-formers* that combine with *bases (fluxes)* and *neutrals (refractories or stabilizers)*.

ADDITIVE: Adding clay to surface of work as forming/decorating method. See *subtractive*.

AIR-FLOATED; AIR-FLOATING: Industrial method used in processing of raw clays, where powdered clay is floated in an airstream to settle out heavier particles.

AIR-SET; AIR-SETTING: Castable refractory or mortar that develops hardness and strength before firing and must be kept damp during curing to develop maximum strength.

AIR-SHUTTER: Adjustable opening on the rear of an *atmospheric burner* or on the blower intake of a *power-burner*, used to regulate *entrainment* of *primary air*.

AGATEWARE: Wares featuring swirling marbled colors resulting from surface slip effects or use of marbled colored clays.

ALKALINE: Basic, opposite of acidic - chemical nature of many *fluxes*.

ALKALINE EARTHS: A category of *highfire fluxes* that includes *calcium, magnesium, barium,* and *strontium*. Encourage hard, durable surfaces, and *matt* surfaces in greater amounts.

ALKALINE FLUXES: Major category of fluxes including *boron, sodium, potassium,* and *lithium*.

ALUMINA: Aluminum oxide – the primary stabilizer/refractory in clay and glazes.

ALUMINA WAX: Wax resist with alumina added, one teaspoon per pint. Used to prevent *plucking* and sticking during glaze firing, especially with porcelain bodies.

ALUMINUM SILICATE: Broad category of materials composed primarily of *alumina* and *silica*. Includes raw-materials such as clay and *feldspar*, as well as fired clay and glaze.

AMORPHOUS: Materials such as *glass* that have no regular repeating *crystalline* structure.

ANAGAMA: Translates “cellar kiln” – traditional Japanese kiln evolving from the *bank-kiln*, and featuring a long, swelling inclined tubular ware chamber, with lower extreme serving as *firebox*. Characteristically produces heavy *flame-flashing* and *residual-ash* effects.

ANNEALING: The process of cooling a heated object gradually to allow internal shrinkage stress to equalize without damage from *thermal shock*.

APPLIQUE: Low-relief clay shapes added to scored, slurried leather-hard surface for decoration, as in traditional German salt-glazed jugs and tankards.

ARCH BRICK: Bricks with angled side faces, tapering across the width of the brick, which when laid together form a curved arch. Standard arch brick give 4 ½”-thick arch.

ASH-SLAGGING: Heavy deposition of *fly-ash* that melts on surface of wares, furniture, and/or

kiln interior in woodfiring.

ATMOSPHERIC BURNER: A gas burner that utilizes the effect of gas escaping from an orifice to *entrain primary air*, without the need for a mechanical blower.

ATMOSPHERIC FIRING: Firing processes where glaze surface is deposited by atmosphere within the kiln, including *salt-firing, soda-firing, and woodfiring*. See *vapor glazing*.

ATOMIC VIBRATION; MOLECULAR VIBRATION: Constant motion of all atoms and molecules in all materials. Application of heat accelerates atomic vibration, eventually causing *dissociation* of *compound molecules* to simpler ones and transition from solid to liquid to gas.

AVENTURINE: A glaze featuring iridescent metallic flecks as a result of iron crystals just beneath the surface.

BACK-BURNING: In burners, when speed of air/fuel mixture exiting tip of burner is slower than combustion and flame jumps back down burner tube to fuel *orifice*, resulting in smoky orange flame and over-heated burner tube.

BACK PRESSURE: In a fuel kiln, the internal pressure resulting from proper balance of combustion pressure and *damper* setting, resulting in more economical and efficient *heatwork*.

BAG WALL: *Refractory* wall in some fuel-burning kilns to deflect heat and flames from immediate direct contact with the wares.

BALL CLAY: *Secondary* clays deposited in marshy areas. Very fine particle size, high *plasticity*, high drying shrinkage, high in organic contaminants. Fire white or off-white.

BALL MILL: A mechanically revolving vessel for grinding clay and glaze materials to finer particle size. Ball-mill vessel is filled 1/3 with ceramic and water mixed to flowing consistency and 1/3 with grinding media (flint pebbles or highfired porcelain balls), and 1/3 empty to encourage tumbling of contents.

BANK KILN: Early form of East Asian kiln where tubular chamber was excavated in an earthen bank. Predecessor to *anagama* and *tube kiln*.

BANDING WHEEL: Hand-operated turntable for applying wax resist, banded decoration, etc.

BARREL ARCH; ROMAN ARCH: Kiln arch that forms a perfect half circle, with the arch beginning and ending on a horizontal surface, using no *skew* bricks.

BASALT BODY; BASALT WARE: Clay body with enough content of dark clays and/or metallic *oxides* to fire very dark brown or black.

BASES: In glaze chemistry, the *fluxes* or melting agents that are combined with *acids (glass-formers)* and *neutrals (refractories/stabilizers)*.

BASO VALVE: Safety shut-off valve used on most gas kilns, operates on minute electrical current generated by *thermocouple* heated by pilot flame. *Natural-draft* kilns equipped with Baso system often need no external electrical hookup.

BAT: Rigid flat disc of wood, plastic, or plaster placed on wheel-head. When thrown form is completed, bat is lifted off wheelhead, avoiding damage to form and surface.

BAT PINS: *Allen socket cap-screws* attached to metal wheelhead to hold bat in place. Current standard is pins spaced on 10" centers. See *bat*.

BEADING GLAZE; BEADED GLAZE: A specialized *controlled-crawl glaze* designed to crack and contract into isolated islands that melt into beads of glaze on the surface.

BELL KILN: A kiln with a stationary floor where the kiln body can be raised upwards on vertical tracks, simplifying loading and unloading large or awkward forms.

BENTONITE: *Montmorillonite* clay formed from airborne **volcanic ash**. Finest particles of any clay, extremely plastic, shrinkage too high to be used alone. 2% to 3% added to clay will increase plasticity, added to glaze will improve suspension and raw glaze adhesion.

BISQUE-FIRING: Initial kiln firing in which clay **sinters** without **vitrifying**, producing porous wares strong enough to stand up to the glazing process.

BISQUE ROLLER; ROULETTE; COGGLE: Small stamp-wheel with raised pattern around rim, which when rolled along plastic clay surface impresses band of relief pattern. Usually formed of damp clay or carved from leather hard or dry clay and bisque-fired.

BLACK-BODY RADIATION: Phenomenon where any material heated to around 900 degrees begins to emit infrared radiation.

BLACK-CORING: See carbon-coring.

BLACKWARE FIRING: Bonfiring smothered with organic combustibles such as sawdust or dried, crushed manure at maximum heat and then buried in sand, dirt, or ash to trap smoke, causing wares to turn black.

BLISTERING: Glaze defect where fired glaze surface contains bubbles that can break open and leave sharp-edged craters. Most often caused if **volatilization** of materials is still occurring when kiln is shut off, freezing bubbles in place. Solution is allow time for glaze maturation, including brief soak in **oxidation** atmosphere at end of firing to allow surface defects to heal.

BLOATING: Firing defect where blisters form *within* claybody, raising lumps on the surface. Caused by expansion of gases within clay, as a result of excessive early **reduction** (trapped carbon - **carbon coring**), excessively fast **bisque-firing** (trapped carbon and sulfur), or over-firing (**volatilization** of **fluxes**).

BLUNGE; BLUNGING: The process of mixing a glaze or slip with a motorized impeller mixer.

BLUNGER: A stationary motorized impeller mixer used in preparing glaze or casting slip.

BODY REDUCTION: Period of reduction atmosphere induced at cone-08 to encourage speckles in the claybody or at cone-012 to encourage certain glaze effects such as copper reds and carbon-trap shinos.

BONE CHINA: Translucent porcelain containing bone-ash.

BONE DRY: Completely dry and very brittle state of clay before firing.

BONFIRE FIRING - Earliest and most basic firing process where wares are fired in an open bonfire. See **blackware firing**.

BOURRY-BOX: Specialized wood-kiln **firebox** where **primary air** enters at top of **firebox**, passes down through wood, and combustion occurs at level of **grates** supercharged by heat of **coalbed**. Heat and flames enter firing chamber below **grate**-level.

BREAKING: In glazes, phenomenon where a glaze gives different colors in thick and thin areas – the color **breaks** from thick to thin. Accentuated in reduction firing when glazes re-oxidize to different color in thinner areas, as in Temmoku breaking from black to brown, or copper red from red to clear.

BURNISHING: Method of **polishing** unfired clay or slip by rubbing with smooth hard object.

CALCINE: In ceramics, to heat a material to red heat in order to purify and stabilize by driving off volatiles including chemically-combined water.

CALIPERS: Adjustable tool for measuring inside/outside diameters, as in making lids.

CARBON-CORING; BLACK-CORING: Firing defect where excessively fast bisque-firing and/or excessive early *reduction* retard *outgassing*, trapping carbon within claybody. As clay *vitrifies* and becomes *pyroplastic*, trapped carbon can expand and cause bloating.

CARBON-TRAPPING: Usually purposeful effect where carbon is trapped within surface of the glaze, giving black or smoky shaded areas, especially in *shino* glazes higher in sodium fluxes. Encouraged by starting body reduction at cone-012 and maintaining partial reduction to maturation, and/or by brushing saturated soda-ash solution over glaze.

CAR KILN; SHUTTLE KILN: Kiln where kiln floor and often door are mounted on a car rolled into kiln on tracks. Shuttle kiln sometimes has two cars with doors on both ends of kiln.

CARPAL-TUNNEL SYNDROME: Serious affliction of wrist resulting from stressful repetitive-motion activity such as hand-wedging clay. See *pugmill*.

CASTABLE: Short for castable refractory - a refractory mix that can be cast into molds to form kiln parts.

CASTING FORMS: Reusable forms for casting plaster when making molds. See *cottles*.

CATENARY ARCH: A parabolic kiln arch requiring no buttressing or steel frame, laid out by hanging a metal chain from two points and marking the resulting curve.

CELADON: Classic East-Asian transparent or translucent glaze containing 1-6% *iron oxide* to give range of soft greens from light to olive, sometimes tending towards blue, gray, or amber. Occasionally show slight opalescence from minute air-bubble *inclusions*. Contemporary celadons often contain *copper* and/or *chrome* to vary quality of green.

CENTERING: First step in throwing, where pressure applied to spinning mass of clay transforms it into a symmetrical, compressed lump. See *coning*.

CERAMIC FIBER: Ceramic insulating material composed of spun *kaolin* fibers formed into flexible blanket, braided tape, rigid board, or tubular flue-liners. Highest insulating rating of standard *refractories*, but releases carcinogenic fibers and will not stand up to abrasion or atmospheric firing.

CHAMOIS: Soft, pliable leather, moistened and used for smoothing wet clay surfaces.

CHARGE: A quantity of chemical material such as *salt* or *soda* inserted or injected into hot kiln during *vapor-glazing* processes.

CHARGING: Inserting or injecting a *charge* of chemical material into a kiln during *vapor-glazing* processes such as *salt-firing* or *soda-firing*.

CHECKERED: In wood kilns, a bagwall or flue-wall with bricks and openings alternating like a checkerboard.

CHEMICALLY-COMBINED WATER: Water in molecular combination within clay and glaze materials, *outgasses* and escapes from kiln during *water-smoking* period of firing.

CHINA CLAY: See *kaolin*.

CHINA PAINTS; OVERGLAZE ENAMELS: Very-low-temperature glaze colors applied over a previously-fired higher-temperature glaze. Allow great detail, bright colors, but vulnerable to

surface abrasion in utilitarian ware.

CHINOISERIE: European pottery featuring decoration inspired by imported Chinese Ming and Ching Dynasty ware.

CHUCK: On the wheel, a temporary wet-clay form or re-useable dry or **bisque-fired** form upon which wares may be inverted for **trimming**.

CHUN: A pale gray-blue feldspathic traditional Chinese stoneware glaze featuring opalescence due to **inclusions** of phosphorous, generally from **bone ash**.

CLAY: Widely occurring **aluminum silicate** mineral resulting from natural decomposition of **feldspar, granite, rhyolite, or volcanic ash**. Composed of smooth, flat, sub-microscopic **platelets** that have affinity for water and give **plasticity**.

CLAY-GLAZE INTERFACE: Contact face between clay and glaze. On lowfired wares, primarily just physical interlocking of glaze into pores in clay. In highfired wares, far stronger interaction of clay and glaze reinforced by **mullite** crystals.

CLAY MEMORY: Result of particle alignment and grain-structure during forming whereby a clay shape will “remember” how it was formed and may shrink according to these qualities. If not accommodated and neutralized can cause warping or cracking in drying/firing, especially slab forms.

CLAYBODY: Clay mixture formulated of clays and other ceramic raw materials to give desired working characteristics.

CLIMBING KILN: East-Asian kilns featuring single or multiple firing chambers climbing up a slope with each zone or chamber preheating subsequent ones. See **anagama, noborigama, tube kiln, sequential firing**.

CLIMBING REDUCTION: See **partial reduction**.

CLOSED FORM: Wheel-thrown or handbuilt form closed off completely and often altered to create vessel or sculptural component.

CMC LIQUID: The common way of adding CMC gum to a glaze or slip. Stir 30 grams of dry CMC powder in 1 qt. hot water and let sit for 2 days.

COEFFICIENT OF EXPANSION: Measurement of material’s tendency to expand when heated, contract when cooled. High **coefficient of expansion** means low **thermal-shock-resistance**. Coefficient of expansion of clay and glaze must be compatible. See **thermal expansion**.

COGGLE: see **bisque roller**.

COIL CONSTRUCTION: Ceramic forming method utilizing rope-like coils of plastic clay assembled in successive courses to build up wall of sculpture or vessel.

COLLARING; NECKING-IN: Process of reducing diameter of neck of thrown form by working walls of rotating form inwards with fingers or rib, as in bottle forms.

COLLOID; COLLOIDAL: Gaseous, liquid, or solid **inclusions** remaining suspended within glaze melt without dissolving into melt; often coagulating to form visible particles. Example: red copper oxide in copper-red glaze, phosphorus in chun glaze.

COLOR-ACTIVE SLIP: Slip of a composition that affects color of glazes placed over it, generally from content of coloring oxides or color modifiers.

COMBING: Decorating technique where toothed instrument is dragged over soft clay surface

or layer of slip.

COMBUSTION: Reaction initiated when fuel reaches *kindling temperature*, at which point *oxidation* of *hydrocarbon* gases releases heat, sustaining and accelerating reaction.

COMPRESSION: In wheel-throwing, hand or finger pressure upon clay resulting in lower moisture content and denser structure. See "*S*"-cracks.

CONE: See *PYROMETRIC CONE*.

CONING: Working clay up and down in cone shape on potter's wheel during centering to align *platelets* in spiral formation and thus increase control in centering and throwing.

CONTINUOUS KILN: Industrial tunnel and rolling-hearth kilns where firing zone remains continuously at maturing temperature and wares move slowly through kiln.

CONTROLLED-CRAWL GLAZE: A glaze designed to *crawl* as glaze materials shrink into separate patches during drying or early red heat, producing alligator-skin or *beaded* effect. See *crawling, beading glaze*.

CONVECTION: Transference of heat through moving air currents.

CONVECTION CURRENTS: Currents created when warmer, lighter air rises upwards.

COOLING RAMP: Profile or schedule of temperature change in cooling of kiln. See *firing ramp*.

COPPER RED; FLAMBE; OXBLOOD; SANG DE BOEUF: Midrange and highfire reduction glazes low in alumina with very small percentage of copper that under correct firing conditions gathers into *colloidal* particles of *red copper oxide* giving bright red color.

COTTLES: Adjustable wooden forms used to create a *mold-box* for casting plaster molds.

CRACKLE: see *crazing*.

CRACKLE GLAZE: A glaze designed to *craze* for decorative effect. See *crazing*.

CRAWLING: Glaze fault where glaze recedes away from an area in the firing, leaving bare clay. Usually caused by dusty, dirty, or oily surface beneath glaze or by excessively powdery glaze. In some cases results from very high *L.O.I.* in glaze materials, causing high glaze-shrinkage and resulting cracking during firing. Used intentionally in *controlled crawl* and *beading* glazes.

CRAZING: Very fine surface cracks in fired glaze surface – technically a flaw that weakens ware, but often sought-after in *crackle glaze*.

CRISTOBALITE: Alternate crystalline form of silicon dioxide forming at temperatures above 2200°F from excess silica has not been incorporated into *glassy-phase*; has very high *coefficient of expansion* and thus low *thermal-shock-resistance*. Aggravated by repeated firing, excessive *soaking*, or excessively slow firing/cooling at high temperatures. Adequate balance of *feldspar* and *silica* in claybody combine in glassy-phase, preventing cristobalite formation.

CROSS-DRAFT: Fuel-burning *downdraft* kiln where heat enters at floor level on one side of ware chamber and exits at floor level on opposite side.

CRYSTALLINE: Solid material characterized by regular repeating geometric molecular structure or lattice and specific melting point, as compared to *glass*, an *amorphous* non-crystalline material that softens over broad temperature range. See *glass, super-cooled liquid*.

CRYSTALLINE GLAZES: Highfire and midrange low-alumina glazes in which significant *macrocrystalline* structure seeded by *zinc* forms in glaze surface during cooling. Feature large patches of visible crystals as compared to *microcrystalline* effects in *matt* and *saturated-iron*

glazes.

CUERDA SECA: Decorating technique where design is outlined in oxide-tinted wax resist, and intervening spaces coated with glazes. Finished result shows areas of glaze divided by dark unglazed lines.

CULLET: Crushed window or bottle glass occasionally used as glaze material.

CYLINDER KILN: First stage in kiln evolution beyond bonfire, consisting of cylindrical clay wall containing fire and wares roofed with layer of **shards**.

DAMPER: In fuel-burning kilns, sliding **refractory** plate in exhaust **flue** allowing control of **back-pressure** and thus **secondary air**, regulating firing efficiency and kiln atmosphere.

DARTS; DARTING: Term borrowed from sewing, referring to pieces cut and sometimes removed from a slab-built or thrown form, where the edges of the opening are drawn together and joined or overlapped to create altered 3-D volume.

DEAIRING: The process of removing air from plastic clay mass, usually accomplished by **wedging** or far more effectively with vacuum de-airing **pugmill**.

DEFLOCCULATE; DEFLOCCULATION: Process of adding **alkaline** material (**deflocculant**) to water **suspension** to introduce like electrical charges to particles, causing them repel one another and remain in **suspension**. A **deflocculated suspension** flows more easily with less water content and thus lower drying shrinkage - especially important in **slip-casting**.

DEVITRIFICATION: Phenomenon that can occur early in the glaze cooling cycle when certain materials crystallize out of the **vitrified** glaze.

DISPERSION: Natural effect of **molecular vibration** causing materials dissolved in liquid **solution** to go from area of high concentration to area of lower concentration. In firing this aids even distribution of dissolved materials throughout **glaze melt**.

DISPERSOIDS: In **glaze-melt**, **inclusions** that disperse throughout the melt without dissolving into the **glassy-phase**. Examples are **titanium**, **tin**, or **zirconium** particles, **colloidal copper**, or minute air bubbles.

DISSOLUTION: Action of a solvent material upon a solid to soften it and/or bring it into liquid solution, such as **fluxes** upon **silica**. During glaze firing, the point at which the **glassy-phase** dissolves **sintered** structure of glaze, producing true **amorphous** glass.

DOWNDRAFT: Kiln where exhaust exit **flue** is at floor-level. Requires chimney to develop **convection** currents needed to draw off exhaust; favored for **reduction** firing.

DRAFT: The flow of exhaust gases exiting a fuel kiln, affecting intake of flames and secondary air.

DRAFT: In all casting processes, slight slope within the mold on surfaces vertical to the face of the mold sections, allowing castings to easily pull free from the mold.

DRAW-RINGS; DRAW TRIALS: In **vapor-glaze** processes like salt-firing and soda-firing, small rings of clay formed to stand vertically, placed in kiln just inside **spyhole** and removed with an iron rod during firing to gauge degree of glaze deposition.

DRAWING: The removing of wares from a kiln.

DRILL-MIXER: Electric-drill-mounted impeller-mixer for mixing glazes, slips, and slurries and for **blunging** casting-slip.

DUNTING: Traditional term for serious cracking in wares cooling in kiln, resulting from excessively fast cooling, from extreme **glaze-compression**, from low-**thermal-shock-resistance** in over-**vitriified** wares resulting from over-**fluxing** and/or over-firing, or from **crystalite** build-up in clay.

EARTHENWARE: **Lowfired** ware, usually still porous after firing – must be sealed with **vitreous** glaze to be functional.

EARTHENWARE CLAY: Natural **lowfire secondary** clay - **fluxed** with iron, fires porous. Often called "common" clay, found almost everywhere, matures below 2000°F.

EFFLORESCE, EFFLORESCENCE: Formation of crystalline deposits on surface of clay or concrete as soluble compounds migrate to surface during drying. See **Egyptian paste**.

EGYPTIAN PASTE: Self-glazing clay body in which soluble **alkaline fluxes effloresce** to the surface as the piece dries and form a thin glassy coating in firing.

ELEMENT: Any of a group of slightly over 100 substances that can theoretically be reduced to individual atoms and from which all materials on earth are composed. See **periodic table of the elements**.

ELEMENTS: In electric kilns, the heating coils.

ENAMELS: see **china paints**.

ENGOBE: Slip formulated with less plastic clay to give low drying shrinkage, allowing application to **bone-dry** or bisque-fired surface before glazing. Commercially-prepared engobes are called **underglazes**.

ENTRAINED AIR: **Primary air** that feeds initial combustion, drawn into the rear entry port of an **atmospheric burner** or mechanically injected into a **power burner**.

EUTECTIC: Phenomenon where two materials in combination melt at lower temperature than either by itself. Example: **lithium carbonate** and **silica** each melt at cone 32 (3100°F) but mixture of 55% **silica** and 45% **lithium** develops **eutectic** and melts at cone 06 (1830°F).

EXTRUDER: Machine that forces plastic clay through a die to produce extruded clay shapes.

EXTRUSIVE: Generally fine-grain **igneous** rocks that cool quickly on the surface, such as obsidian and basalt.

FACETING: Decorating technique involving cutting or paddling flat facets in the clay surface.

FAIENCE: Widely used (and misused) term referring to **earthenware** pottery with opaque glaze (usually white) and **overglaze** decoration applied to raw glaze surface, or to glaze used for this decoration. Best-known faience tradition/technique is **maiolica**.

FEATHERING; FEATHER-COMBING: Decorating technique where a soft, fine pointed tool is drawn through adjacent bands of contrasting-colored liquid slip applied to damp clay surface.

FELDSPAR: Category of **intrusive igneous aluminum silicate** minerals used in highfire claybodies/glazes, contributing **fluxes** including **potassium, sodium, lithium,** and/or **calcium**. Parent mineral from which **kaolinite** clay forms.

FELDSPATHIC: Feldspars or other closely-related minerals including **nephylene syenite, Cornwall stone,** etc.

FETTLING KNIFE: Long tapered knife useful for many studio tasks including trimming cast or pressed pieces and for separating mold components.

FIBERFRAX: Ceramic fiber insulation materials made by Unifrax. See *ceramic fiber*.

FILLERS: See *tempering materials*.

FIREBOX: Section of fuel-burning kiln where fuel gases combust before contacting wares. Gas kilns need little if any firebox. Wood or oil produce long hot flame requiring large firebox except in wood kiln when *flame-flashing* and *ash-slugging* are sought.

FIRE CLAY: Highly *refractory secondary* clays with minimal *fluxes* and usually fairly coarse particle size - low shrinkage, buff-color, often non-*plastic*.

FIRE-EYE: Ultraviolet sensor used on industrial burner systems to monitor burner flame. See *flame-rectification*.

FIRING CONE; TARGET CONE: In a cone pack, the cone indicating the target temperature.

FIRING DOWN: Maintaining some heat input after maturation to retard cooling in order to encourage beneficial crystal-growth or to maintain reduction atmosphere during cooling. See *reduction-cooling, zone of crystallization*.

FIRING RAMP: Profile or schedule of heating cycle in a kiln-firing including speed, duration, soaking periods, often also including *cooling ramp*.

FLAME-FLASHING: Surface effects caused by direct flame contact on wares.

FLAME-OFF; BLOW-OFF: In burners, flame flaw occurring when speed of air/fuel mixture exiting tip of burner is greater than combustion rate - flame jumps off tip of burner and often extinguishes.

FLAME-RECTIFICATION: Burner system with automated reignition feature that immediately restores flame should it become extinguished, incorporating *fire-eye* ultra-violet sensor to monitor burner flame and spark ignition to reignite flame.

FLAME-RETENTION TIP: Gas burner tip that creates turbulence, intermixing gas and air, speeding up combustion, holding flame at burner tip, preventing both *flame-off* and *back-burning*.

FLAMEWARE: Wares made to withstand stove-top heat. Explosions from trapped moisture, and resulting lawsuits have caused most studio potters to abandon flameware.

FLASHING: Color change in fired clay or slip due to direct flame contact and residual ash deposition in wood firing, or due to variable currents of vapor deposition in salt and soda firing. Flashing can occur on almost any light-colored clay body, but is most dramatic on some porcelain bodies and slips.

FLASHING SLIP: Specially formulated slip painted, sprayed, or dipped onto wares to promote *flashing* effects in the firing.

FLINT: See *SILICA*

FLOCCULATE; FLOCCULATION: The process of adding acidic substance (*flocculant*) that gives particles in suspension opposite electrical charges, causing them to attract one-another (to flock together) - disadvantage in casting slip but advantage in claybody or decorating slip. Usually only claybodies high in *kaolin* need to be flocculated by adding ½ of 1% (of dry batch weight) Epsom salts. *Flocculation* also useful to thicken up glaze to keep it in suspension and improve application properties.

FLOWING COAT: A coat of glaze applied in a fluid state, generally by dipping or pouring,

encouraging the glaze to deposit more thickly in recesses. Can also be applied with a heavily-loaded high-capacity brush like a hake brush, or by maintaining a wet, flowing “puddle” on the surface when spraying.

FLUE: Passages in kiln for flames or exhaust gases.

FLUTING: Decorating technique involving carving or forming pattern of parallel vertical *flutes* or grooves in surface of piece.

FLUX: Low-melting component in clay or glaze that reacts with *silica* to form *glass*.

FLY-ASH: Airborne ash in a wood-kiln.

FOOT: Base of a ceramic piece.

FORCED-DRAFT: Direct-connected exhaust system with suction fan, used on commercial furnaces, never on studio ceramic kilns; often mistakenly used to refer to *forced-air* system.

FORCED-AIR: Firing system in a fuel-burning kiln that uses power-driven blowers or other pressurized air-source to *entrain primary air*.

FRACTURE PLANE: Weak planar connection when clay components are pressed straight together with little or no disrupting of surface to intermix *platelets*. Parts hold together while wet and tacky but separate easily when dry or fired. See *scoring*.

FRIT: Ceramic materials combined, melted to a *glass*, ground back to powder in order to provide raw material with desirable characteristics such as lower toxicity or water insolubility.

FRITTING; FRITTED: Process of melting ceramic materials to glass and grinding to form a *frit*.

FUSION; FUSED: In *glaze-melt*, point where *dissolution* of *sintered* structure is complete, and all *refractory* particles are dissolved into glaze melt, forming *fused* material – one that has melted to liquid.

GALLERY: In covered vessels, shelf-and-collar system supporting lid, giving tight seal and holding lid securely in place with minimal lateral movement.

GLASS: *Super-cooled liquid* that softens and hardens over broad range of temperature and cools to form *amorphous*, non-crystalline solid. Level and rate of stiffening (*viscosity*) controlled by temperature and addition of *fluxes* and *stiffeners* make possible wide temperature-range of ceramic clays and glazes.

GLASS-FORMER: Primary material that in combination with *fluxes* forms glass essential to all fired ceramics. Key *glass-former* at all temperatures is *silica*.

GLASSY-PHASE: In heating ceramic materials, point where *glass-formers* and *fluxes* combine and soften to form glass. See *glass, sintering, dissolution*.

GLAZE: Coating of powdered ceramic materials usually prepared and applied in water suspension that melts smooth and bonds to clay surface in *glaze firing*. See *clay-glaze interface*.

GLAZE CALCULATION SOFTWARE: Software that facilitates designing, repairing, modifying glaze formulas, converting from *batch recipe* to *unity formula* in order to compare with standardized *target formulas*. Popular software includes *Insight, Hyperglaze, GlazeChem*, and *Matrix*.

GLAZE COMPRESSION: In midrange and highfired wares, state of *thermal expansion* where clay body shrinks slightly more than glaze, putting glaze under compression. Slight compression

gives greater strength, resiliency. Inadequate or excessive glaze compression results in defects including *crazing* and *shivering*.

GLAZE-FIRING: Kiln firing in which glazes are melted to form smooth glassy surface.

GLAZE-FIT: Matching of glaze to claybody in terms of composition and *coefficient of expansion* so that it will adhere permanently. See *glaze-compression, clay-glaze interface*.

GLAZE-MELT: During firing, chemically-active state of melted glaze.

GLAZE-RESIST: Decorating technique where *resist* materials such as wax, tape, adhesive paper or stickers are applied to prevent glaze from adhering to certain areas.

GLAZE SGRAFFITO: Decorating technique where glaze is carved or incised away to reveal claybody beneath. A coat of wax before carving helps, and gives the option of brushing or dipping with a contrasting glaze that will deposit only in carved areas.

GPD: See *green-packing density*.

GRAIN-STRUCTURE: Linear alignment of clay platelets resulting from application of pressure to plastic clay. If not equalized or neutralized, unidirectional grain structure can cause uneven shrinkage resulting in warping/cracking, especially in slab-work. See *clay memory*.

GRANITE WARE: Ware with mottled slip or glaze treatment to create appearance like granite.

GRATE KILN: Early form of cylindrical kiln originating in Middle East with below-ground firebox, perforated clay floor (grate) supporting wares, and piled shard roof.

GREEN; GREENWARE: Unfired ware whether dry or still damp.

GREEN GLAZING; RAW GLAZING: Glazing *leather-hard* or *bone-dry* wares for *single firing*.

GREEN-PACKING DENSITY; GPD: Distribution of particle sizes in a claybody. Good green-packing density means broad range of particle sizes resulting in adequate water layers giving good plasticity, more contact points giving good working structure and dry/bisque strength, and less water spaces giving lower drying/firing shrinkage.

GROG: Filler or tempering grit formed by grinding highfired clay; added to claybodies to reduce shrinkage and improve working structure for throwing or handbuilding.

GROUNDHOG KILN: Long, low horizontal *sprung-arch* or *barrel-arch* woodfired kiln partially buried in ground to insulate and buttress arch, used by traditional potters in southeast US.

GUARD CONE: In a cone pack, the cone above the *firing cone*, telling you that you have passed the target temperature.

GUM ADDITIVES; CMC GUM: Water soluble organic thickeners often added to glazes or slips as suspension and/or brushing agent. Also used to allow glaze adhesion to non-porous previously-glaze-fired surfaces. Most commercial lowfire glazes/underglazes contain gum additives.

HAKE, HAKEME BRUSH: Both terms mean “brush” in Japanese. A wide, soft, high-capacity brush appropriate for broad surface coverage and for laying *flowing coats* of slip or glaze.

HALLOYSITE: One of several common clay minerals besides kaolinite; forms from *hydrothermal decomposition* of *rhyolitic* minerals. Rarely used in North America, but elsewhere in porcelain and bone china. Some halloysite present in *Helmer* kaolin.

HANDBUILDING: Forming plastic clay by hand without wheel, using *pinch, coil, slab*, and/or *solid construction*.

HARDBRICK: Hard, dense firebrick generally used only in high-stress areas of kiln-construction

(floor, firebox, burner ports, flues, bagwall) and for hotface in corrosive firing processes (salt, soda, wood).

HARD-PASTE: Traditional European term for *highfired porcelain*.

HEATWORK: Work done by effective heat-transfer to wares, maximized by maintaining proper back-pressure on fuel kilns, and from temperature, duration, specifics of firing ramp on all kilns.

HEPA: High Efficiency Particulate Arrestance – industrial designation indicating dust filtration capable of blocking microscopic particulates like silica dust.

HIGHFIRE: High-temperature firing range from cone-8 to cone-12 for *stoneware* and *porcelain*.

HIGH-VOLUME-LOW-PRESSURE: See *HVLP*

HISPANO-MORESQUE: Decorative style originating in Moorish Spain, characterized by extremely elaborate patterning and curvilinear plant motifs; major influence on Italian Maiolica, Art Nouveau, Arts and Crafts Movement.

HOTFACE: Interior refractory surface of kiln.

HVLP; HIGH-VOLUME-LOW-PRESSURE: Refers to spray-guns designed to operate on low air pressure, creating far less overspray, less waste. Best HVLP sprayers run on dedicated turbine system, but the popular HVLP *conversion spray-guns* run off standard air compressor.

HYDROCARBON GAS: Combustible gas containing hydrogen and carbon such as LPG or natural gas or produced when carbon-based liquid or solid fuel is heated above *kindling temperature*.

HYDROMETER: Laboratory device for measuring *specific gravity* in liquids. Accurate in thin suspensions like terra sig, far less accurate in glazes/slips. See *specific gravity*.

HYDROTHERMAL: Affected by hot water or steam, as in hydrothermal decomposition of rock.

HYGROSCOPIC: The property of absorbing water from the air, as in chips of calcium materials like plaster, limestone, or marble causing *lime-pops*. See *lime-pops*.

IFB: See *insulating firebrick*.

IGNEOUS: Rocks/minerals solidified from lava or magma.

IMPELLER MIXER: See *drill mixer*.

IMPRESSING: Decorating technique where tool or textured/patterned material or object is pressed into clay to create surface relief.

INCISING: *Subtractive* decorating technique where design is formed by cutting or carving shallow lines in clay surface.

INCLUSIONS: Particles or bubbles of material remaining undissolved, suspended within *glaze melt*, affecting glaze appearance.

INSULATING FIREBRICK; IFB; SOFTBRICK: Porous firebrick with insulating value much higher than *hardbrick*.

INTERMITTENT KILN; PERIODIC KILN: Common type of studio kiln, loaded cold, brought to temperature, cooled and unloaded, as compared to *continuous kiln*.

INTRUSIVE: Generally coarse-grained crystalline *igneous* rocks that cool slowly underground, such as *feldspar* or *granite*.

IRON OXIDE: Most abundant coloring material on earth, contributes to brick-red, brown, gray, and black colors in fired clay, can create green, brown, black, brick-red, orange, and yellow in minerals and glazes. Red *ferric* oxide very *refractory* in *oxidation*, but in *reduction* converts to

black **ferrous** oxide, a powerful **flux**.

JASPER WARE: Ware developed by Wedgwood in which colored porcelaineous stoneware is decorated with contrasting raised relief slip or applique imagery.

JIGGERING: Partially mechanized vessel-forming process on potter's wheel where pivoting arm (**jigger** arm) with mounted rigid profile rib is brought down against centered clay ball within or upon wheel-mounted mold.

JUG FINGER; POTTER'S FINGER: Variation of throwing stick, wooden tool with knob on lower end often covered with chamois to hold moisture. After **necking-in** throat of jug, vase, or bottle, jug finger is inserted and used to broaden and refine shape.

KAKI: Highfired Japanese **saturated iron glaze** containing at least 10% iron oxide giving iridescent **microcrystalline** rust red. See **tessha**.

KANNA: Japanese trimming tool, formed of hard steel strap bent at 90° and sharpened on one or both ends.

KAOLIN; CHINA CLAY: **Primary clay** that fires pure white - coarse particle size, low **plasticity**, high-temperature - major component of **porcelain** and **whiteware** bodies.

KAOLINITE: Crystalline clay mineral forming basis of most clays, formed by long-term **hydrothermal** decomposition of **feldspathic** minerals.

KAOWOOL: Ceramic fiber insulation products made by Thermal Ceramics. See **ceramic fiber**.

KERAMOS: Greek term meaning **earthenware** from which the word **ceramics** is derived.

KEYS; REGISTRATION MARKS: In plaster **slip-casting** molds, small rounded depressions carved in connecting faces of a mold segment, so that when adjacent segments are cast a corresponding bump will form. In use, **keys** allow mold segments to be easily aligned and assembled securely after the original prototype is removed.

KILN FURNITURE: **Refractory** shelves, **posts**, and **stilts** used in a kiln to support the wares.

KILN SITTER: Automatic mechanical shut-off device still used on many electric kilns; accepts a small-size pyrometric cone and shuts off kiln when cone deforms.

KILN WASH: **Refractory** slip coating applied to top surface of kiln shelf to protect from glaze runs. For all but salt, soda, wood firings, 50-50 **kaolin** and **silica**. For salt, soda, wood, 50 **alumina**, 40 **kaolin**, 10 **ball clay**.

KINDLING TEMPERATURE: In combustion of fuels, temperature that must be reached before combustion reaction will produce sufficient heat to self-sustain and accelerate. For wood and paper, **kindling** temperature is 451°F.

LEATHER-HARD: Condition of clay stiffened but still damp, ideal for joining and most surface modification and trimming. **Soft-leather-hard** for forming, joining, thick slip-decorating.

Medium-leather-hard for thin slip-decorating, joining, incising, carving, piercing, trimming.

Hard-leather-hard for thin slip-painting, carving, scraping, **green-glazing**.

LIME POPS: Defect in bisque/glaze ware when clay is contaminated with chips of calcium materials (limestone, plaster, chalk) that dissociate to calcium oxide in firing; **hygroscopic** after firing and absorbs water to become calcium hydroxide, expanding in process, causing pop-out of small chip. Can occur in bisqueware or glazed ware, soon after firing or years later.

LIMIT FORMULAS: Set of **unity formulas** giving ideal range of each ceramic oxides that can be

present in glaze, used in glaze calculation to compare/adjust/design unity formula of glaze.

LINE BLEND: Method for testing glaze materials, where proportional amounts vary through a series of samples between two limits. May involve change in glaze material or addition of colorant or modifier. See *triaxial blend*.

LOSS ON IGNITION; L.O.I.: The portion of any ceramic material, clay, or glaze that *volatilizes* and *outgasses* during firing; includes carbonates, sulfates, nitrates, organic contamination, chemically combined water.

LOWFIRE: Low-temperature firing range, usually below cone-02 (2048°F), used for most bisque-firing and for glaze firing *earthenware* bodies like *terracotta*.

LOW-MIDRANGE: Firing range usually including cone 01 to cone 3. Under-used in studio ceramics but useful for functional *earthenware*, *refractory* sculpture bodies, and outdoor *earthenware* claybodies subjected to hard freeze.

LUGS: Small loop handles or perforated bosses on or below the neck of many traditional storage jars to allow attachment of a cover.

LUSTER: Metallic overglaze finish created by painting prepared luster (metallic salt in organic binder) over fired glaze and refiring to cone 018.

LUTING: English word for attaching clay forms with slurry.

LYE: Potassium hydroxide or sodium hydroxide. Caustic alkaline soluble that leaches out of wood ashes in water. *Toxic, may cause burns*.

MDF; MEDIUM-DENSITY FIBERBOARD: Compressed wood product showing no visible grain, ideal for mounting tiles and relief sculpture in order to hang or install on the wall.

M.S.D.S.; MATERIAL SAFETY DATA SHEET, available from your supplier or online giving toxicity information about each ceramic material you use.

MACROCRYSTALLINE: Glaze effect featuring large patches of visible crystals on glaze surface, as compared to *microcrystalline* effects. See *crystalline glaze*.

MAGIC WATER: Joining medium developed by Lana Wilson, often used by clay workers in place of slurry for joining wet or soft-leather-hard forms. Combine 1 gallon water, 3 tablespoons liquid *sodium silicate*, 1½ teaspoons *soda ash*.

MAIOLICA: Type of *earthenware* pottery, generally *terracotta*, with opaque base glaze and colored decoration applied directly to unfired glaze surface, not to be confused with *majolica*. See *faience*.

MAJOLICA: Historic English style of brightly glazed *earthenware* vessels made in the form of vegetables, barnyard animals, etc., not to be confused with *maiolica*.

MAKE-UP AIR: Air supply entering from outside a closed building containing a fuel kiln to replace kiln exhaust leaving the building.

MANOMETER: Primitive gauge for measuring *water column inches* consisting of a “U”-shaped glass tube partially filled with water, with pressure source connected to one end. See *water column inches*.

MATT GLAZE: Glaze featuring non-reflective, non-glossy surface.

MATURITY; MATURING POINT: Firing point at which a claybody or glaze reaches the desired state of color, hardness, density, etc.

MICROCRYSTALLINE: Crystal effects dependent on tiny crystals in the glaze surface, as compared to *macrocrystalline* effects.

MIDRANGE: Glaze-firing range from cone-4 to cone-7, very popular with electric kilns.

MISHIMA: East Asian slip-inlay decorating method where shallow design is incised into leather-hard surface, filled with contrasting slip, and excess scraped off when hard-leather-hard. See *wax mishima*.

MODIFIERS: Glaze materials not part of base glaze, added to modify surface qualities such as color or opacity.

MOLD-BOX: A reusable casting box used when casting plaster molds. See *cottles*.

MOLD-RELEASE COMPOUNDS: In making plaster molds, compounds applied to surfaces except damp clay to prevent plaster from sticking. We generally use liquid hand soap.

MOLECULAR VIBRATION: See *atomic vibration*.

MOLECULE: A group of two or more atoms bonded together.

MONTMORILLONITE: Clays such as *bentonite* formed by *hydrothermal* decomposition of *volcanic ash*. Finest particle-size of all clays, thus very high shrinkage. See *bentonite* .

MOUSE-HOLE: Small air-port and passage in some wood kilns admitting air beneath *coalbed*.

MUFFLE KILN: Fuel-burning kiln where flames/combustion gases are ducted through sealed *refractory* flues within ware chamber, heating wares while maintaining *oxidizing* atmosphere.

MULLITE: Very desirable interlocking needle-like *aluminum silicate* crystals that form above 1800°F adding strength to highfired *vitrified* claybodies and to *clay-glaze interface*.

MULTI-FIRED: Wares subjected to more than one glaze firing to achieve particular surface effects, as in *lusters* and *china paints*.

NATURAL DRAFT: Firing system in a fuel-burning kiln that uses natural convection currents in kiln (*updraft*) or in chimney (*downdraft*) to draw in *secondary air*, circulate heat and atmosphere through kiln, and exhaust combustion gases without any mechanical blowers.

NECKING-IN: See *COLLARING*.

NEUTRAL ATMOSPHERE: In fuel-burning kiln, atmosphere that is neither *oxidizing* nor *reducing* – most efficient for even temperature climb before body reduction is initiated.

NEUTRALS: In glaze chemistry, the *refractories* or *stabilizers* that are combined with *bases (fluxes)* and *acids (glass-formers)*.

NOBORIGAMA: Translates "step-climbing kiln" - Traditional Japanese multi-chamber *downdraft/crossdraft* climbing kiln with initial *firebox* at bottom, secondary *fireboxes* in each chamber. As kiln is fired, each chamber preheats the next. See *sequential firing*.

NON-PLASTICS: Non-clay components of claybody such as feldspar, talc, flint, grog, etc.

NUKA: A milky white Japanese highfire glaze containing rice-hull ash.

OPACIFIER: In glaze formulation, material that introduces inert *inclusions* or forms crystals in glaze causing opacity. Most common are *tin oxide* and *zirconium silicate*.

ORIFICE: In gas or oil burner, restricted opening through which jet of fuel emerges.

OUTGASSING: Escape of gases from clay and glazes during firing. *Carbonates, sulfates, nitrates*, organic contaminants, and *chemically-combined water* volatilize between 900 and 1400°F. Other compounds, especially *fluxes* can begin to volatilize later during *glaze-melt*. See

water-smoking period, carbon coring, oxidation cleanup.

OVERGLAZE: Surface decoration applied over glaze surface, either directly on raw unfired glaze as in *maiolica*, or on fired glaze and refired to lower temperature, as in *china paints*.

OVERSPRAY: In pressurized spraying of glazes or other mediums, spray that does not settle on object and is wasted. Proper *spray-booth* is essential to exhaust overspray. See *HVLP*.

OXIDE: Simple molecule containing any element along with oxygen.

OXIDE WASH: Mixture of coloring oxide and water, sometimes including a little flux, used as an overall patina under glaze or without glaze or for overglaze brushwork. See *patina*.

OXIDIZE: To subject a material to high-oxygen atmosphere, encouraging *oxidation* reactions.

OXIDATION: Chemical reaction in which atoms or molecules take on oxygen atoms.

OXIDATION CLEANUP; OXIDATION SOAK: After period of *reduction* in firing, short period of *oxidation* to allow *outgassing* to stop, encouraging bright colors and healing of flaws.

OXIDATION FIRING: Kiln atmosphere maintained with abundance of oxygen to *oxidize* ceramic materials. Includes all electric firings, any fuel firing with adequate air to insure quick combustion of all fuel.

PADDLE AND ANVIL: Forming technique where *soft-leather-hard* form is shaped and thinned with paddle on outside, and rounded “anvil” of stone, wood or bisque-fired clay on inside.

PADDLING: Technique of shaping a *soft* or *medium-leather-hard* piece by gently hitting with a wooden paddle (sometimes textured) to create flat facets or resolve irregularities in form.

PAPER CLAY: Claybody or slip containing paper pulp that reduces drying shrinkage and encourages very strong joinery allowing unconventional joinery such as wet to dry.

PAPER CLAY SLURRY: Repair medium that can join bone-dry clay. Combine equal parts finely-divided paper pulp and powdered claybody and add vinegar to achieve desired slurry consistency. It is essentially “pickled” and will not spoil.

PAPER RESIST: Decoration technique where strips of moist or adhesive paper is adhered to the surface to resist application of slip or glaze.

PARTEX: Commercial mold-release agent preferred by many mold makers. See *mold-release*.

PARTIAL REDUCTION; CLIMBING REDUCTION: Slightly-reducing kiln atmosphere to promote and retain reduced effects while allowing increase in temperature. See *reduction firing*.

PASSIVE DAMPER: Ports in a kiln exhaust flue or chimney that can be opened or closed to allow outside air into the chimney as a way of regulating draft.

PATE-SUR-PATE: Paste-on-paste - decoration in which sculptural relief decoration is built up with contrasting slip on surface of leather-hard ware. See *Jasper ware*.

PATINA: Watered-down wash of glaze, stains, or coloring oxide applied to bisqueware, allowing color/texture of claybody or slip to show through. Often applied and sponged off high spots before glazing. See *oxide wash*.

PEELING: Serious glaze flaw when slip, underglaze, or glaze contracts early in firing and peels from clay surface in sheets or flake and melts in blobs on clay surface or kiln shelf. Causes include excessively thick glaze application, very powdery bond with clay surface, surface contamination (dust, oil, grease, wax), or in rare cases firing that is interrupted and cooled after sintering but before bonding of clay and glaze and then refired.

PEEPHOLE: See *SPYHOLE*.

PERIODIC TABLE OF THE ELEMENTS: Table listing all chemical *elements* in order of atomic weight and grouped by similar physical/chemical properties.

PHYLOSILLICATES: Minerals with sheet lattice molecular structure that cleave into thin, flat particles or planes, including *kaolin* (and other clay minerals), *talca*, *mica*, and *serpentine*.

PINCHING: Hand-building method where clay is pinching repeatedly between thumb and fingers or between fingers of one hand and palm of opposing hand.

PINHOLES; PINHOLING: Glaze defect characterized by tiny openings in fired glaze. Causes include pinholes already present in dry unfired glaze coating, or burst bubbles in glaze surface not given opportunity to “heal” at end of firing, aggravated by inadequately-high or excessively-fast bisque-firing that doesn’t allow complete *outgassing* of *volatiles*. See *oxidation cleanup*.

PIT-FIRING: Type of *bonfire-firing* where wares are buried in sawdust (sometimes along with chemicals and other materials) in pit in ground, bonfire is built on top, fire and coals slowly burn away sawdust and fire the wares.

PLASTICITY: Quality of particle adherence and moldable flexibility in damp clay. Superior *plasticity* depends on adequate content of small *platelets*, slight acidity, minimum of *non-plastics*, age of damp claybody, adequate water content, and/or addition of accessory *plasticizers* like *Veegum-T* or *Macaloid*. See *green-packing density*.

PLASTICIZERS: Materials added to some claybodies, especially those high in kaolins, to increase plasticity and dry strength - includes *bentonite*, *Macaloid*, *Veegum-T*. Also includes range of industrial organic plasticizers used in some porcelain throwing bodies.

PLATELETS: In ceramics, clay particles. See *clay, plasticity*.

PLUCKING: Glaze flaw where chips around base of piece remain stuck to kiln shelf when kiln is unloaded. Can be due to inadequate shelf wash or to glaze residue left in pores of bottom after glazing. Most often a problem with porcelain bodies, and can usually be eliminated by waxing feet with alumina-wax resist mixture (1 tsp. alumina to 1 cup wax resist).

POLISHING: Process of creating shiny surface on unfired clay or slip by *burnishing* or by rubbing with soft cloth, soft brush, or piece of plastic film. See *burnishing, terra sigillata*.

POP-OUTS: See *lime pops*.

PORCELAIN: Midrange/highfire *vitreous* claybodies containing *kaolin*, *silica*, and *fluxes*, plus often *ball clay* and/or *bentonite* for greater *plasticity*. Usually white or “eggshell” in color, sometimes translucent where thin.

PORCELANEOUS STONEWARE: White-firing stoneware claybodies closely related to porcelain.

POSTS: *Refractory* column-shaped kiln furniture to support kiln shelves.

POST-FIRING SMOKING: Technique where wares are removed from kiln at red heat and subjected to smoky atmosphere, impacting carbon in craze-lines and unglazed clay. See *raku*.

POTTER’S FINGER: See *jug finger*.

POWER BURNER: Burner in which mechanical blower or other pressurized air source *entrains primary air* for combustion.

PRESSING: Method of forming multiples by pressing plastic clay into plaster *press-mold*.

PRIMARY AIR: In fuel-burning kiln, air that feeds initial combustion. In wood-burning kiln, air

that feeds base of flames. In gas kiln, air that enters back end of **atmospheric burner** tube or blower of **power burner**. See **secondary air**.

PRIMARY CLAYS; RESIDUAL CLAYS: Clays that remain at site of parent rock and are thus free of contaminants but coarse in particle size and low in plasticity. Includes purest **kaolins**.

PSI: Pounds per square inch – standard measure of compressed air pressure and of high-pressure LPG/propane pressure in adjustable regulators. See **water column inches**.

PUGMILL: Machine similar to over-sized meat-grinder used to homogenize plastic claybodies. Deairing pugmill employs vacuum pump to remove air, eliminating need for hand-wedging.

PYROMETER: Temperature gauge connected to **thermocouple** indicating temperature within kiln. Provide good general reference but only respond to temperature, whereas clay and glazes (and **cones**) are affected by temperature, duration, atmosphere of firing. See **pyrometric cones**.

PYROMETRIC CONES: Small slender pyramid-shaped indicators formulated to bend at specific temperature. Standard method for determining progress and maturing temperature of firing. Like clay and glazes, cones respond to temperature, duration, and atmosphere of firing far more accurately than mechanical measurement.

PYROPLASTIC; PYROPLASTICITY: Flexibility in clay when heated beyond red heat, resulting from progressively-developing **glassy-phase**.

QUARTZ: see **silica**.

QUARTZ INVERSION: Expansion in heating and corresponding contraction in cooling occurring in crystalline silica in clay and glazes at around 1063°F. Of primary concern in cooling bisque-firing when most silica is still in crystalline form, but of little concern in midrange or highfiring of properly designed claybodies and glaze where silica has been incorporated into **glassy phase**.

RAKU: Traditional Japanese family line, type of ware, and type of firing where tea bowls are fired singly in small charcoal kiln. In the West, firing process inspired by Japanese raku where work is removed from kiln at bright red heat and subjected to **post-firing smoking**.

RAM-PRESSING: Industrial production method where clay is formed in hydraulic **ram-press**.

RAMP: See **firing ramp**.

RAW GLAZING: See **green-glazing**.

RE-CRYSTALLIZATION: During initial cooling, formation of **microcrystalline** or **macrocrystalline** structure in glaze surface. See **zone of crystallization**.

REDUCE: In fuel kilns, to induce **reduction**.

REDUCING AGENT: In **reduction firing**, hydrogen and carbon monoxide liberated from unburned **hydrocarbon** gases that **reduce** clay and glazes by lifting oxygen atoms. Or, material such as **silicon carbide** in glazes or organic binder in commercial **lusters**, introduced to create localized **reduction** in **oxidation firing**. See **reduction firing**.

REDUCTION: Chemical reaction in which oxygen atoms are removed from a compound.

REDUCTION COOLING: In a fuel kiln, maintaining light reduction atmosphere during cooling cycle, generally from maturing temperature down to 1400°F in order to maximize reduced effects and minimize re-oxidation. See **re-oxidation**.

REDUCTION FIRING: In fuel-burning kilns, firing atmosphere with insufficient oxygen to completely combust fuel, introducing carbon monoxide and hydrogen into kiln as **reducing**

agents that extract oxygen from clay and glaze, altering appearance. See **partial reduction**.

REFRACTORY: Capable of withstanding very high temperatures.

REFRATORIES: In clay and glazes, see **stabilizers**. In kiln construction, high-temperature insulating materials such as firebrick, **ceramic fiber**, etc.

REGISTRATION MARKS: See **keys**.

RESIDUAL ASH: In woodfiring, surface effects created by **fly-ash** settling on the wares.

RESIDUAL CLAYS: See **primary clays**.

RESIDUAL SALT-GLAZE; RESIDUAL SALT-FIRING: Light salt-glaze effect resulting from revolatilization of sodium from walls of seasoned salt kiln without **charging** additional salt.

RESIST: Materials such as wax, tape, stickers, or contact paper applied to clay surface to prevent adhesion of slip or glaze.

RHEOSTAT: Variable electric switch found on some **forced-air** burners to control blower speed.

RHYOLITE; RHYOLITIC: Category of **extrusive igneous** rocks high in silica; parent rock of **halloysite** clays.

RIB: Wide, flat hand-held tool with straight, curved, and/or profile edge, either rigid or flexible, used for shaping, smoothing, and/or scraping clay.

ROMAN ARCH: See **barrel arch**.

ROLLED EDGE: Beveled edge obtained by rolling outer edge of foot of **soft-leather-hard** pot at an angle against hard, flat surface.

ROULETTE: See **bisque roller**.

"S"-CRACKS: "S"-shaped cracks appearing in bottom of wheel-thrown pots due to inadequate compression of bottom and/or excessive water left in bottom. Occur most often in fine-grain gritless claybodies, especially thrown off the hump.

SAGGER; SAGGAR: **Refractory** clay enclosure in which wares are fired within kiln, originally to protect wares from **ash-slugging** and **flame-flashing** in woodfiring, but now often used in clean-burning gas and electric firings for opposite purpose. See **sagger-firing**.

SAGGER-FIRING: Contemporary firing process in which wares are placed in **refractory saggars** within kiln along with chemicals and combustibles in order to achieve certain surface effects.

SALT FIRING; SALT GLAZE: **Vapor-glazing** process where moistened salt (sodium chloride) is introduced into kiln firebox at high temperature. Salt vaporizes, and **sodium** vapor combines with **silica** in clay surface, forming extremely hard **sodium-silicate** glaze. See **soda firing**. Flue exhaust includes hydrogen chloride gas that causes corrosion on nearby metal surfaces.

SAND: Granular silica. Major grit besides grog used to give claybodies structure for throwing and handbuilding.

SATURATED IRON GLAZE: see **kaki**.

SAWDUST SMOKING; SAWDUST FIRING: Cosmetic smoking process where unglazed wares are buried in sawdust in brick enclosure or perforated steel drum. Sawdust is ignited at top and allowed to smolder down over period of hours. Often mistakenly referred to as **pit-firing**, but does not achieve true firing temperatures and wares must be bisque-fired first.

SCORING: Process of abrading or incising surface of wet or leather hard clay in cross-hatch pattern before applying slurry and joining pieces.

SCUMMING: Gray or white surface discoloration on bisque-fired wares resulting from soluble sulfates of magnesium and calcium migrating to surface during drying or when wares sit for prolonged period before firing. Can usually be cured by adding 0.1% to 0.25% (¼ of 1%) barium carbonate to claybody to render sulfates insoluble.

SECONDARY AIR: In fuel burning kilns, air that enters after initial combustion and feeds flames as they leave primary combustion source. In gas kiln, *secondary air* enters burner port around burner-tip. In wood kiln, *secondary air* enters above *grates* in conventional *fire-box*, and below *grates* in *Bourry-box*. See *primary air*.

SECONDARY CLAYS; DEPOSITED CLAYS; SEDIMENTARY CLAYS: Clays that have been transported away from their point of geologic origins by wind or water. Finer particle-size gives greater *plasticity*, but contaminants are introduced – includes *earthenware clays*, *ball clays*, *stoneware clays*, *fireclays*, etc.

SECONDARY KAOLINS: *Kaolins* that have been transported some distance from the parent rock and are still very pure, but far more plastic than *primary kaolins*.

SEQUENTIAL FIRING: Firing in sloped tube kiln or noborigama where as each zone or chamber reaches maturity the next one is stoked, and each preheats subsequent chambers or zones.

SGRAFFITO: Decorating technique achieved by incising or carving through layer of slip or glaze (helps to apply wax-resist over glaze before carving) before firing to expose contrasting claybody beneath. See *glaze sgraffito*.

SHARD: Broken fragment of pottery.

SHEET LATTICE: Molecular structure of certain minerals like *mica* and *kaolin* that cleave into thin, flat sheets or particles. See *phyllosilicates*.

SHINO: Classic Japanese glaze ranging from gray to white to orange containing large percentage of soda feldspars and often soda ash and/or *spodumene*. Shinos with less gloss contain more clay. Orange *fire color* is achieved with thinner glaze application when fluxes activate iron content in the claybody or by red clay added to glaze. See *carbon-trapping*.

SHIVERING: Serious and dangerous glaze defect where excessive *glaze-compression* causes small razor-sharp chips of glaze to pop off along outer edges, corners, and rims. Cure is to slightly increase *flux* and/or slightly decrease *silica* in glaze.

SHORT: Clay with insufficient *plasticity* - tends to fragment during forming.

SHRINKAGE: Permanent contraction of clay in both drying and firing stages. Overall may be as much as 18%.

SHUTTLE KILN: See *car kiln*.

SIEVE: Metal or plastic pan with fine-mesh wire screen in bottom opening, available in different mesh-sizes, used for straining slips and glazes.

SIEVING: The process of working a glaze or slip through a wire-mesh sieve to strain out impurities, and to break up clumped raw materials.

SILICA; SILICON DIOXIDE; FLINT; QUARTZ: Primary *glass-former* in clay and glazes.

SILICON CARBIDE: Extremely *refractory* material used to form kiln shelves. Highly resistant to corrosive atmospheres and therefore suitable for salt, soda, and woodfiring. Silicon carbide kiln shelves conduct electricity and should not be used in electric kilns. Occasionally used in

powdered form as local **reducing agent** in glazes for **oxidation** firings.

SINGLE-FIRING; GREEN-FIRING: Process of glaze-firing glazed **greenware** without a bisque-firing.

SINTERING: In firing, reaction beginning around 900°F where surfaces of particles become tacky and bond in weak structural mass that can no longer be slaked down to plastic clay.

SINTERED MASS: Any porous mass of particles bonded together at their contact points.

SKEW BRICKS: Special angled bricks used to support first course of **arch bricks** on either side of a **sprung arch**.

SLAB-ROLLER: Mechanized but usually manually operated device for rolling out large uniform slabs of clay.

SLAKING; SLAKE DOWN: Process of returning dry unfired clay to slurry by soaking in water.

SLIP: Clay suspended in water, usually the consistency of thick cream. May be colored and used to decorate surfaces, or may be cast into plaster molds to create ceramic forms.

SLIP-CASTING: Creation of ceramic forms by casting slip in plaster molds.

SLIP CLAY: Naturally-occurring clay containing high enough component of **flux** (usually iron) to form glaze at **highfire** temperatures.

SLIP GLAZE: Glaze with **slip clay** or **earthenware** clay contributing primary **flux**.

SLIP-RESIST: Decorating technique where **resist** materials are applied to prevent slip from adhering to some areas. See **resist, wax mishima**.

SLIP-TRAILING: Application of decoration to wet or **soft-leather-hard** clay by flowing on lines of **slip** with a fine pointed dispenser such as a rubber bulb or hair-tint bottle.

SLUMP MOLD: Mold over which moist clay slab is slumped in order to create a particular form.

SLUMPING: Process of creating ceramic forms with slump molds.

SLUMPING: Firing defect where **glassy-phase** begins to dissolve **sintered** structure in clay, causing it to sag and deform, usually because of overfiring or excessive flux.

SLURRY: Very thick clay **slip**, often used for joining clay pieces after **scoring** surfaces.

SOAP: Specialized **hardbrick** shape half the width of standard brick. Useful for posts in salt and wood firings.

SOAK: Period of **soaking** during firing. See **soaking**.

SOAKING: During **firing** or **cooling-ramp**, holding kiln at particular temperature for period of time to allow proper formation or **maturation** of certain clay and/or glaze effects.

SODA FIRING; SODA GLAZE: **Vapor-glazing** process giving less-invasive/corrosive effects than **salt-firing**. Gives slightly less orange-peel. Instead of salt, **soda ash (sodium carbonate)** in water solution is sprayed into kiln at maturing temperature, and **sodium** vapor combines with **silica** in clay to form **sodium-silicate** glaze. Flue exhaust includes **sodium hydroxide** gas that is highly corrosive to nearby metal surfaces.

SOFTBRICK: See **insulating firebrick**.

SOFT PASTE PORCELAIN: A white claybody loaded with glassy frit in order to mature at lower temperature, producing dense, brittle ware. Traditional European term for precursor to true porcelain.

SOLID CONSTRUCTION: handbuilding method where clay forms are built solid, cut into pieces,

hollowed out, and reassembled before firing.

SOLUTION: A liquid mix where the components are fully dissolved (as in a water/*soda ash* solution for *vapor-glazing*) and materials will not settle out via gravity.

SOLVENT: Agent acting to accelerate *dissolution* of more resistant material. In clay/glaze-maturation, *flux* is solvent on *silica*, and resulting *glassy-phase* is solvent on *alumina*.

SPALLING: Kiln defect where *hotface* surface of brick peels away, generally after repeated firings beyond rated temperature or when over-saturated with salt/soda fumes.

SPECIFIC GRAVITY: Weight/density of liquid compared to that of water. Liquid with specific gravity of 1.2 is 1.2 times as dense as water per unit of measure. See *hydrometer*.

SPLIT: Specialized hardbrick half the thickness of a standard brick.

SPOOZE: Repair medium for bone-dry *greenware* originated by Peggy Heer, made of equal parts vinegar and corn-syrup mixed with dry powdered claybody to desired consistency.

SPRAYING: Application of liquid *slip*, *engobe*, *glaze*, or *patina*, generally using compressed-air-powered spray equipment. Gives smooth glaze coating but with less glaze-pooling in recesses unless glaze is allowed to puddle slightly on surface.

SPRAY-BOOTH: Open-front enclosure with an exhaust fan at rear, designed to draw off all *overspray* and other dust or fumes.

SPRAY-GUN: Device for spraying glazes, patinas, slips, or underglazes, generally powered by compressed air. See *HVLP*.

SPRIGGING: Additive surface decorating technique where small coils or balls of clay are affixed to damp or *leather-hard* surface, usually with layer of slip.

SPRUNG ARCH: Kiln arch representing less than 180° of curvature, and requiring buttressing to support outward thrust of the arch.

SPYHOLE; PEEPHOLE: Small holes in kiln door or wall allowing checking of backpressure and viewing of cones, flames, wares, and/or atmosphere during firing.

STABILIZERS: In clay and glaze chemistry, materials that are resistant to melting and combine with *fluxes* and *glass-formers* to contribute structure in clays and *viscosity* in glazes. Primary *stabilizer* in clays/glazes is *alumina*.

STAIN: Commercial *fritted* ceramic colorants giving truer color before firing and greater stability, firing range, and color range than pure ceramic oxides.

STILT: Term often applied to kiln posts, but refers to specialized furniture with ceramic or metal points designed to support fully-glazed wares during firing.

STONEWARE: Highfired *vitreous* ware, literally as hard as stone. Matures from 2200-2400°F (cone 5-11).

STONEWARE CLAY: Naturally occurring *refractory* clay with adequate *fluxes* to fire in *stoneware* temperature range.

STREAMING: A phenomenon in fuel kilns when excessive damper opening causes heat and atmosphere to *stream* directly from heat source to exit flue, producing very uneven effects.

SUBTRACTIVE: Removing clay from surface work as forming/decorating method. See *additive*.

SUPER-COOLED LIQUID: Material that in solid form maintains *amorphous* physical structure of liquid rather than geometrically ordered structure of *crystalline* material. Crystalline materials

soften/solidify at specific melting/freezing point, while super-cooled liquid like **glass** softens/solidifies gradually over broad temperature range.

SURFORM: Cheese-grater-like woodworking tool excellent for shaving leather-hard clay. Surform is the trademarked Stanley Tool Company version, but similar tools are made by other manufacturers.

SUSPENSION: A liquid mix where insoluble particles are distributed throughout without dissolving and may settle out from gravity, as in a glaze or slip.

TARGET CONE: See **firing cone**.

TEMMOKU: Classic East-Asian high-iron gloss reduction glaze giving black where thick, breaking to brown or red-brown where thin.

TEMPERING MATERIALS; TEMPER; FILLERS: Grit like **sand** or **grog** added to clay to open up body, give physical structure in wet-working, and increase **thermal-shock resistance** in initial firing.

TERRACOTTA: Low temperature, porous **earthenware** claybody, fires red-brown due to high iron content that also **fluxes** clay, making terracotta the most durable of **lowfired** clays.

TERRA SIGILLATA: Ultra-refined clay slip giving soft sheen when applied to **bone-dry** ware, and high gloss if **polished** or **burnished**.

TESSHA: Japanese glaze similar to **kaki** in which re-oxidation and slow cooling give classic kaki iron red but with overall network of small purplish patches of hematite crystals.

THERMAL EXPANSION: Physical expansion and contraction accompanying heating and cooling of most materials. See **coefficient of expansion**.

THERMAL SHOCK: Effect on ceramic forms of sudden temperature-change during firing or subsequent heating and cooling in daily use.

THERMAL-SHOCK RESISTANCE: Resistance to damaging effects of **thermal shock**.

THERMOCOUPLE: High-temperature probe that generates minute variable electrical current dependent on level of heat, used with **pyrometers** and **Baso valves**.

THROWING OFF THE HUMP: Throwing technique originating in East Asia where small vessels are thrown in series off a single large lump of clay.

THROWING STICK: Wooden tool developed by Japanese potters as an extension of the hand for raising the inside of pots, especially tall narrow forms. See **jug finger**.

TOMBO: “T”-shaped Japanese throwing gauge used to measure depth and rim-diameter of small vessel, usually when **throwing off the hump**.

TRIAXIAL BLEND: Method of testing three-way combinations of glaze materials where proportional amounts vary through a series of samples between three limits. May involve change in base-glaze materials or addition of colorants or modifiers. See **line blend**.

TRIMMING: Removal of excess clay at leather-hard stage using any of a variety of sharp cutting tools.

TRIMMING CHUCK: See **chuck**.

TUBE BURNER: Simple tube-shaped **atmospheric burner** with no **venturi** effect present.

TUBE KILN: **Sequential-firing** Korean kiln evolving from Chinese **bank kiln** with long sloping tubular firing chamber. See **sequential firing**.

TUBE-LINING: A slip-decoration technique where high-relief lines of thick slip are trailed from a squeeze bulb or pastry bag, and often provide a barrier for distinct and separate glazed areas, giving an effect not unlike stained glass or cloisonné.

UNDERCUT: Flaw in improperly made plaster or bisque molds where a clay pressing or casting catches under overhang and will not pull free without breaking or distorting. See **draft**.

UNDERGLAZE: Commercially-prepared **engobe**. See **engobe**.

UNDERGLAZE DECORATION: Process of applying decoration (brushed, sprayed, sponged, etc.) to bare clay surface directly before glazing.

UNDERGLAZE PENCILS: **Engobe** pigments in pencil form, excellent for marking wares and test-tiles and for “pencil-drawn” decorative effects.

UNITY FORMULA; SEGER FORMULA: Formula generated by glaze calculation listing oxides present in glaze in separate columns for **fluxes**, **refractories**, and **glass-formers** with fluxes totaling “1” or unity.

UPDRAFT: Kiln in which exhaust gases exit through flue in roof of kiln.

VAPOR GLAZING: Glaze surface resulting from **atmospheric firing** process where glaze is deposited by vapors within kiln atmosphere – includes **salt-glazing**, **soda-glazing**, **fuming**.

VENTURI BURNER: Natural-draft gas burner featuring streamlined restriction in burner tube that increases **entrainment** of **primary air** and efficiency of gas-air mixing.

VISCOSITY; VISCOUS: Reference to material’s resistance to flowing. A viscous glaze flows less.

VITREOUS; VITRIFIED; VITRIFICATION: Fired clay that has **fused** together to point where pores between **refractory** particles are filled with **glass** and body is impervious to water. **Vitrified** clay still has **sintered** structure but with fully-developed **glassy-phase**.

VITREOUS ENGOBE: An **engobe** containing sufficient **flux** to form to a **vitreous** clay coating.

VOLCANIC ASH: Fine volcanic particulate expelled from surface vent in volcanic eruption. Occasionally used in glazes and similar to **feldspar** in composition but usually with significant iron. Parent mineral of **Bentonite** clays.

VOLATILIZATION; VOLATILIZE: Change from solid or liquid to gas during firing, resulting in **outgassing** from clay or glaze. See **outgassing**, **blistering**.

WADS; WADDING: Small balls/rolls of **refractory** clay mixture (40 alumina, 10 ball clay, 50 kaolin) used in **atmospheric firing** processes beneath wares, posts, lids to prevent sticking.

WARNING CONE: In a cone pack, the cone below the **firing cone**, warning that you are close to target temperature.

WARPING: Distortion of clay forms caused by uneven stresses due to **clay memory** from forming method, uneven drying, uneven support in firing, or uneven/excessive heat in firing.

WASH: See **patina**.

WASTER SLAB: Disposable slab used to support a piece in firing.

WATER COLUMN INCHES; WCI: Standard low-pressure measure of gas pressure based on pressure required to lift a column of water in a vertical tube. Household pressure is usually 7 WCI natural gas and 9-11 WCI propane. Industrial natural gas pressure may be 12 to 15 WCI or more. 28 WCI equals 1 PSI (pounds per square inch). See **manometer**.

WATER OF PLASTICITY: Amount of water required to bring a dry clay sample to its state of

ideal **plasticity**. Common clay test since the more water needed, finer the particle size, greater the plasticity, greater the drying shrinkage.

WATER SMOKING STAGE: Stage during bisque-firing or **single-firing** from 900 to 1400°F when carbonates, nitrates, sulfates, organic contaminants, **chemically-combined water** volatilize and **outgas**. See **carbon-coring, outgassing**.

WAX RESIST: Melted wax or wax emulsion used in resist processes. See **resist**.

WAX MISHIMA: Variation on mishima that eliminates scraping and thus works on all claybodies. Coat of wax is applied to leather-hard form, sometimes coated with slip, design is incised through wax, incised area coated with contrasting slip, excess slip sponged off.

WCI: See **water column inches**.

WEDGE BRICK: Bricks with angled side faces tapering along length of brick, which when laid together form a curved arch. Standard wedge brick gives 9"-thick arch. See **arch brick**.

WEDGING: Process of kneading the clay with the hands to remove air-bubbles and insure homogenous mass.

WET-FOOT: Glazing technique used in commercial china industry where entire bottom is glazed and piece is fired on **stilts**.

WHITEWARE: White claybodies fired too low to be considered porcelain.

ZONE OF CRYSTALLIZATION: Period during **cooling-ramp** when particular material tends to crystallize out of **glaze-melt** – generally most active around 1800°F for desirable crystals that give visual texture and mattness.