

Ceramics Overview, Rules, & Vocabulary

What is **Clay**?

Clay is fine-grained earth materials formed by the decomposition of igneous rock; when combined with water, clay is plastic enough to be shaped; and when subjected to red heat or above, it will become progressively more dense and rock-like.

What is **Ceramics**?

Art and Science of forming objects from earth materials containing or combined with the aid of heat treatment at 1300°F or more.

What is a **Kiln**?

Basically an insulated box, which is heated for the firing of pots.

- Different fuels used to heat a kiln are gas, oil, wood, coal (now almost obsolete) and electricity. The maximum operating temperature for most pottery kilns is about 1300°C/2372°F, although many wood fired kilns may be fired up to 1350°C/2462°F.
 - In this class we have multiple electric kilns and a large gas kilns.



TWO MAIN CATEGORIES OF FORMING CERAMICS:

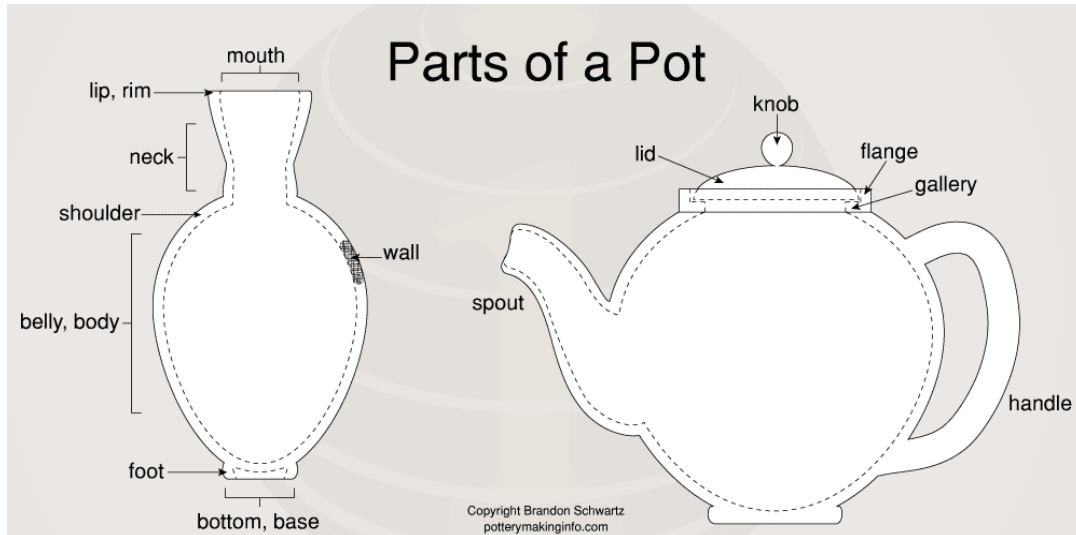
Throwing: The process of forming pieces on a revolving potter's wheel from solid lumps of clay into hollow forms.

Hand-building: Generic term for most processes made without a potter's wheel. (pinch pots, coil pots, slab pots, sculptural works, busts, etc.).



Parts of a Pot:

- **Lip:** The clay part of the opening at the top of a vessel.
- **Mouth:** The measurement of the opening of the top of a vessel.
- **Neck:** The (usually) narrower part that leads from the body of the vessel to the lip.
- **Shoulder:** The transformation from the body to the neck.
- **Body/Belly:** This is the main part of the vessel. It is usually the largest part.
- **Foot (sunken foot rim):** This is the ring of clay at the very bottom.
- **Bottom/base:** Refers to the bottom of the pot.
- **Wall:** The sides of a vessel.



Parts of a Teapot:

- **Lid:** The removable covering top part of a teapot.
- **Knob:** An ergonomic way to grab the lid. Can be thrown hollow.
- **Spout:** The hollow appendage on a teapot with an opening angled to where the opening is the same height as the opening of a teapot to keep tea from spilling.
- **Flange:** a locking mechanism that either sits in the gallery or is an extra ledge for keeping the lid from sliding off the teapot or lidded vessel.
- **Gallery:** A recessed edge for a lid to sit in to make it not slide off.
- **Handle:** Traditionally pulled from a wedge of clay an ergonomic rope like structure attached to a vessel to make it easier to pick up.

STAGES OF CLAY:

- ❖ **Greenware:** Unfired clay
 - 3 main stages of Greenware (drying stages of clay):
 - **Slip:** liquid clay
 - commonly used as a “glue” to combine pieces together with scored (roughed up) surfaces in the leather hard stage. (*Score and slip*)
 - The easiest way to make slip is to gradually sift powdered clay into a small cup of water.
 - **Leather hard:** aka: “stiff clay.” When the clay body has been partially dried and holds its form. This is a large spectrum from semi-leather hard which still has some give for altering and a little bit dryer is ideal for trimming and connecting other leather hard pieces. The “sweet spot” is on the leather hard spectrum when the clay falls away easily and is the most ideal time for subtractive techniques: fluting, faceting, carving lines, relief, piercing, etc.
 - **Bone Dry:** Greenware that has almost no natural water in it. This is brittle clay. (ready to be bisque fired)
- ❖ **Bisqueware:** The term *bisque* refers to ceramic ware that has been fired once without glaze. (First shelf to put work on once it's bone dry - shelf label: Greenware to be Bisque Fired)
- ❖ **Firing:** when works get fired in a kiln.
 - Clay generally goes through 2 firings:
 1. **Bisque Firing:** the first firing that turns greenware to stone.
 - The clay is still porous and can soak up glaze at this stage.
 2. **Glaze Firing:** after glaze has been applied it goes through a glaze firing and the clay is typically fired at a higher temperature so that the clay becomes fully vitrified (becomes glass like - the clay essentially becomes sealed).
- ❖ **Glazeware:** A glass-like surface coating for ceramics that is used to decorate and seal the pores of the fired clay.
 - **Earthenware:** A low fired form of pottery or objects (below 1100°C/2012°F) made from fire clay, which is porous and permeable. The clay can be any color although iron red is usually associated with Terracotta.
 - **Stoneware:** Highly vitrified ceramics fired to above 1200°C/2192 °F. Most of the silica in a fired stoneware body is melted into a glassy matrix and the resulting body is of high density and usually has a water absorption rate of less than 1%.

Atmospheres in Firing Pottery:

- **Reduction:** A kiln firing in which there is insufficient oxygen to consume the free carbon emanating from the heated glaze and clay, resulting in the formation of carbon monoxide. Oxygen-starved carbon monoxide pulls oxygen from the clay body and glaze, forming color changes in the coloring oxides.
- **Oxidation:** Kiln firing with a full supply of oxygen (as opposed to a reduction firing). Electric kilns are this type.

Ways to Apply Glaze:

Dipping: Coating pottery by immersing it in slip or glaze.

Spraying: coating pottery by using an air compressor with a spray gun to coat the piece evenly. (Use a banding wheel to turn the piece).

Pouring: coating pottery by pouring glaze onto the piece or into the piece usually with a catch basin underneath it to catch the excess glaze.

Brushing: coating pottery by brushing it on with brushes.

Sponging: coating pottery with a sponge. Commonly used over underglaze pencil to not smudge the design before dipping.

Common Glaze Problems:

- **Crawling** - Separating of glaze coat during firing, exposing areas of unglazed clay.
- **Crazing** - The undesirable formation of a network of cracks in the glaze caused by uneven clay or glaze contraction.
- **Shivering** - Cracking off of the glaze due to compression during cooling or cracking of glaze on sharp edges.
- **Peeling** - Separation of the fired glaze or slip from a clay surface because the clay has contracted more than the glaze.
- **Pinholing** - Tiny holes that appear in a fired glaze, often caused by poor clay preparation, improper glaze application or incorrect firing.
 - **Crackle Glaze** - A glaze developing minute cracks that are considered decorative and are often accentuated by rubbed-in coloring material.

Hand Building Terms:

- **Hand building:** This term refers to one of several techniques for building pots using only the hands and simple tools rather than the potter's wheel. The term used for creating pottery using the potter's wheel is "throwing."
- **Pinch Pots:** "Pinch" in ceramics is a method of shaping clay by inserting the thumb of one hand into the clay and lightly pinching with the thumb and fingers while slowly rotating the ball in the palm of the other hand. Pots made in this manner are called "pinch pots."
- **Coil Pots:** This is the technique of building ceramic forms by rolling out coils, or ropes, of clay and joining them together with the fingers or a tool.
- **Slab Pots:** In this technique, flat slabs of clay are pressed together to create various shapes or forms.
- **Score and Slip:** *Score and slip* refers to a method of joining two pieces of clay together. First, *score* the clay; this means that you make scratches in the surfaces that will be sticking together. Then you *slip* it; that is when you wet the surface with some slip, using it like glue. Next, you press the two pieces together. It is very important to always *score and slip* clay that is leather hard. If you do not, the pieces will likely pop apart when they are fired.

CLAY RULES

- Soft clay cannot be attached to hard clay, and only pieces that are leather hard or wetter can be attached with much chance of staying together. This is due to the shrinking and flattening of clay particles as the water leaves during drying.
- Pieces of clay to be attached must be scored with a needle, brushed with slip, or slurry, to glue them together. Careful pinching and rubbing of seams may also join very wet pieces.
- Clay pieces may be no thicker than 1/2 inch unless they are hollow, and if hollow spaces are enclosed, a pinhole must be made in the piece to allow gasses and trapped air to escape. Thicker pieces should be allowed to dry THOROUGHLY before firing.
- Dry pots slowly, away from temperature extremes, to prevent uneven drying, shrinkage, and cracking. This is especially true of pieces, which have been joined, such as handles, slab pots etc.
- Avoid stress when building or throwing clay pieces. Unnatural bending or forcing will cause particles to become unaligned, resulting in cracks, either in the drying or in firing.

- Clay must be wedged before using to ensure proper alignment of particles, create uniform texture, and most importantly, to drive air bubbles out. Air bubbles cause clay to explode in the kiln, because of the air expanding with no place to go.
- Unused clay must be covered and wrapped with plastic to prevent drying, or returned to the recycling container.
- NO CLAY DOWN THE SINK!!
- PLEASE HELP CLEAN UP AND KEEP THE FACILITY IN AS MUCH ORDER AS POSSIBLE.

Things to consider when working in clay:

- CLAY SHRINKS!: Through the different firing processes the clay body will shrink. The shrinkage is dependent on the clay body and the firing temperatures to which the specific piece is fired. We can estimate most clay bodies will shrink between 12% & 15%.
-Because clay shrinks, if you are making a mug you will need to make it slightly larger than you want it to be once it's completely bisque fired and glaze fired.
- NOT ALL GLAZES ARE FOOD SAFE: Some glazes are not meant to be food safe for a few reasons: they may contain a high content of a toxic chemical, the glaze might be formulated to craze on purpose causing cracks that bacteria can grow in, the silica content is low in the glaze not allowing the glaze to be fully sealed from moisture and bacteria, or the piece through a firing process, like a raku firing, has undergone dunting (thermal shock) which causes the glaze to crackle.
- NOT ALL CLAY BODIES CAN HANDLE THE OUTDOOR ELEMENTS & SEASONS!
This varies from clay body, glazes used, firing processes, and geographical location, specifically the climate.

- Clay particles are microscopic, plate-like, flat, and hold water between them. The water lets the plates slip and slide together, giving clay its plastic or manipulative quality. The action of the plates and water also accounts for the **problems** encountered during the **drying stages of clay**.

Basic Tools/Equipment

Bat: A thin slab of wood, plaster, or plastic used to support pottery forms during throwing, attached to the head of the potter's wheel by clay body or "bat pins."

Kiln: Basically an insulated box, which is heated for the firing of pots. The fuels used to heat a kiln are gas, oil, wood, coal (now almost obsolete) and electricity. The maximum operating temperature for most pottery kilns is about 1300°C/2372°F, although many wood fired kilns may be fired up to 1350°C/2462°F.

Potter's Wheel: A machine used in the shaping of round ceramic wares.

Ribs: These flexible steel modeling accessories are useful for smoothing and scraping as well as for pottery trimming and leveling the base of thrown clay.

Loop Tools: Double wire end tools are used by ceramists and potters to trim and foot pottery.

Strings: A piece of cutting wire attached to wooden handles used to cut sections of clay in the wedging process and for removing thrown pots from the potter's wheel.

Needle Tool: A universal trimming and cutting tool with an aluminum handle, fine point cutting needle and curved handle support.

Modeling Stick: Used for cutting, slicing, smoothing, contouring and pattern decoration in soft clay. Made from hardwood.

Sponge: Used to absorb excess water applied when bringing up the walls of the pot.

A-Z List of Commonly Used Ceramics Vocabulary:

- Armature - A framework around which clay can be modeled. (typically used in sculpting human figures or busts)
- Bat - A disk or slab of plaster or other material used for drying clay or supporting clay forms while being worked.
- Bisque - Clay which has been fired once, unglazed.
- Bisque Fire - First firing of clay to drive out chemically combined water and carbonaceous materials prior to glazing.
- Bone Dry - The condition of unfired clay that has no absorbed moisture other than natural humidity. (a greenware state)
- Burnish - Using a smooth object to polish the surface of leather-hard clay.
- Casting - A process of forming a clay object by pouring clay slip into a hollow plaster mold.
- Clay - A compound of decomposed and altered feldspathic rock consisting of various hydrated silicates of aluminum along with non-plastics, such as quartz, and organic material.
- Coil - Rope-like roll of clay used in hand building.
- Collaring or Necking - A method of narrowing the neck of a pot by squeezing in the clay with fingers as the pot revolves on the potter's wheel.
- Cone or Pyrometric Cone - A small triangular pyramid made of ceramic materials that are compounded to bend and melt at specific temperatures. The cone serves as a time-temperature indicator of heat work in a kiln.
- Crackle Glaze - A glaze developing minute cracks that are considered decorative and are often accentuated by rubbed-in coloring material.
- Crawling - Separating of glaze coat during firing, exposing areas of unglazed clay. (glaze problem)
- Crazing - The undesirable formation of a network of cracks in the glaze caused by uneven clay or glaze contraction. (glaze problem)
- Dipping - Coating pottery by immersing it in slip or glaze.
- Dunting - Cracking of fired ware in a kiln that has cooled too rapidly.
- Earthenware - Clay that matures at a low temperature but remains porous. (Low fire clay)
- Elements - High resistance wire coils or bars used as the heat source in an electric kiln.

- Fettle or Fettling - To finish or smooth the surface of leather-hard clay. Also to trim the excess clay from cast ware.(Fettling Knife)
- Firing - The heating of clay or glaze to a specific temperature.
- Flux - A substance that promotes the melting of silica in a glaze.
- Foot - The base of a ceramic piece.
- Glaze - A glass-like coating fusion bonded to a ceramic surface by heat.
- Glaze Fire - A cycle during which glaze materials are heated sufficiently to melt and form a glassy surface coating when cooled.
- Greenware - Unfired clay objects.
- Grog - Fired clay that has been crushed into granules that may be added to a clay body to increase strength, control drying and reduce shrinkage.
- High Relief - A strongly raised or deeply carved pattern.
- Impressing - Method of decorating by stamping into a clay surface.
- Incising - Engraving a decoration into unfired clay.
- Kiln - A furnace for firing ceramic products.
- Kiln Furniture - Refractory shelves, posts and other equipment placed in a kiln to hold ware during firing.
- Kiln Wash - A refractory mixture that is applied to the kiln shelves and floor to prevent fired glaze from adhering to them. (50 % Alumina hydrate and 50% EPK)
- Kneading - Working clay on a surface with the palms of the hands in order to remove air from it and obtain a uniform consistency.
- Leather Hard - The condition of raw clay ware when most of the moisture has evaporated leaving it still soft enough to be carved or joined to other pieces. (a greenware state)
- Mold - A plaster or bisqued clay shape from which a clay form can be reproduced.
- Once Fire and Single Fire - A slow firing cycle that combines both bisque and glaze firings.
- Peeling - Separation of the fired glaze or slip from a clay surface because the clay has contracted more than the glaze. (glaze problem)
- Pinholing - Tiny holes that appear in a fired glaze, often caused by poor clay preparation, improper glaze application or incorrect firing. (glaze problem)
- Pyrometer - A bi-metallic strip that translates heat energy into electrical energy used to indicate the temperature in a kiln. (the kiln's "thermometer")
- Refractory - The quality of resistance to high temperatures. Also, high alumina silica material used in the manufacture of kiln furniture and interiors.
- Rib - A hand held tool made of hard material used to shape a pot when throwing. (We use wood, metal, and rubber ribs)
- Sagging - The slumping of a form while the plastic clay is still soft.
- Sedimentary Clay - Clay that has been transported from its original site by water, air or ice and deposited in layers elsewhere.
- Sgraffito - A decorative process by which a line is scratched through a layer of slip or glaze before firing to expose the clay body beneath. From the Italian, meaning "scratched out".
- Short - Clay that is non-plastic and breaks and crumbles easily.
- Shrinkage - Contraction of the clay or glaze in either drying or firing
- Spyhole - The opening in a kiln wall or door through which cones may be viewed during firing. Can also act as a steam vent during the early stages of firing.
- Stilt - A ceramic tripod used to support glazed ware in a kiln during firing.
- Stoneware - A grey to buff, non-translucent clay body that matures between 6 and 10 cones. (high fire)
- Terra Cotta - A brownish-orange earthenware clay body, commonly used for ceramic sculpture or architectural ornament. From the Italian, meaning, "baked earth".
- Throw or Throwing - To make pottery by hand on the potter's wheel. A delicate balance, which defies gravity and centrifugal force as clay is coaxed up by hand from a spinning turntable.

- Trimming - A method of paring away excess clay, usually from the bottom of pot to form a foot, while the clay is leather hard.
- Underglaze - A colored decoration applied on raw or bisque ware before the glaze is applied.
- Vitreous - The hard, glassy and nonabsorbent quality of a clay body or glaze.
- Vitrify or Vitrification - To fire to the temperature at which a clay or glaze attains its mature, hard, glass-like quality.
- Wedge or Wedging - Mixing and de-airing clay by cutting it diagonally and slamming the pieces together.
- Wheel Head - The turning disk on a potter's wheel on which the clay is thrown or worked.