

## Ceramics

### The Firing Cycle

When the ware is “bone dry,” it is stacked into a kiln for firing. “*Bone dry*” means the ware feels completely dry. It has the look and feel of dried bones. The clay isn’t really dry. It can’t be, because our atmosphere is never zero humidity. Thus the drying is completed in the kiln. The **firing cycle** is what we call the whole process of firing ware in the kiln.

### WATER SMOKING

When the temperature in the kiln reaches 212°F, all remaining water of plasticity is burned off. This is the first in a series of critical points. Water boils and turns to steam at 212°F. It doesn’t matter whether you are boiling eggs or firing clay; it’s the same kind of water, and it does the same thing. If the steam leaves the clay too fast, the pot explodes; if you boil eggs too fast, they crack. Fire the kiln slow and easy with the door open a crack to allow the steam a chance to escape. In large kilns, enough steam is often generated to be seen. For this reason the early part of the firing cycle is called **water smoking**.

### DEHYDRATION

As the temperature increases to 660°F, the chemical water (the H<sub>2</sub>O that is part of the chemical make-up of all clay -- Al<sub>2</sub>O<sub>3</sub> • 2SiO<sub>2</sub> • 2H<sub>2</sub>O) starts to burn off. By 950°F the clay is completely **dehydrated** -- all the chemical water has been burned off. The clay is now a chemically different material than it was when put into the kiln. It is now an aluminum silicate known as mullite. (Al<sub>2</sub>O<sub>3</sub> • 2SiO<sub>2</sub>). This change is not reversible.

### THE QUARTZ INVERSION

The next critical change begins at about 1000°F. The **quartz** crystals in the clay undergo a change called the **quartz inversion**. The crystals grow and change in shape. Just as with the water smoking period and the burning off of the chemical water, the quartz inversion has to be done slowly.

### OXIDATION

**Oxidation** (the burning off of organic materials) occurs at 1600°F to 1700°F. This has no chemical effect on the clay, but it does leave the clay more porous. This is an advantage when glazing bisque ware.

### VITRIFICATION

Partial **vitrification** begins as the temperature rises. This will be determined by the type of clay body. Clay with a high alumina content (stoneware and porcelain) will vitrify more slowly and at a higher temperature than clay high in fluxes such as iron or talc (earthenware). Vitrification, you will remember, is melting of the clay platelets. Complete vitrification results in a glasslike material; therefore, clay ware is never completely vitrified.

*Supply the missing word to complete the statement below.*

1. Clay isn't completely dry until the water of plasticity is burned off and it has been fired to a temperature of over \_\_\_\_\_ .
2. If a pot is fired too fast, it will probably \_\_\_\_\_.
3. When all the chemical water has burned off, the clay becomes a chemically different material known as \_\_\_\_\_. This change is not reversible.
4. At about 1000°F, the quartz crystals change. This is called the \_\_\_\_\_. The crystals \_\_\_\_\_ and change shape.
5. The burning off of organic material is called \_\_\_\_\_.
6. A clay goes through \_\_\_\_\_ stages before it is mature, They occur in this order:
  - 1) \_\_\_\_\_
  - 2) \_\_\_\_\_
  - 3) \_\_\_\_\_
  - 4) \_\_\_\_\_
  - 5) \_\_\_\_\_