Ceramic Glazes

Even ancient potters knew that after their earthenware vessels had been fired, the clay walls remained slightly porous, allowing stored liquids to percolate slowly to the outside.

Peoples on the island of Fiji attempted to deal with this problem by applying vegetable varnishes to the inner surface of their pots.

A later technique for sealing earthenware involved the application of a glaze—a finely ground glass powder usually suspended in water. The glaze was painted, dipped, or sprayed on a fired pot, both inside and out. When the pot was fired a second time, the glaze would melt and form a fused, amorphous layer of glass, sealing the clay pores.

In ancient Greece around the 4th century B.C., the art of pottery reached a high point with two distinctive forms of glaze—black figure, in which a design of shiny black glaze was painted on a background of red clay, and red figure, where the entire background was painted black except for the design, which was left as plain red clay.

The red and black colors were the natural results of the same Attic clay under different conditions. The iron oxide in the clay turned red when it was fired in an oxidizing atmosphere (in a well-ventilated kiln) and black in a reducing atmosphere (in a smoky, air-restricted kiln, usually caused by throwing wet wood into the fire). To obtain both colors on the same vase, the object was first fired in a well-ventilated kiln to produce the usual reddish color of terra cotta, then it was painted with another coating of the glaze and fired again in a reducing kiln, which turned the fresh layer black.

Examples of Egyptian pottery from the third millennium B.C. have a similar two-toned effect, which was perhaps created by half-burying a vase in sand while it was being fired, leaving the top to remain red while the bottom turned black. The technique of glazing red and black vases spread from Rome to Gaul and across Europe to Roman Britain by the second century A.D.

As glazes became more sophisticated, a flux was added to the ground-glass and water mixture to lower the melting temperature of the glass. The flux also affected the properties and appearance of the glaze.

An alkaline glaze made with a flux of ash (containing soda ash from burned marine plants or potash from the ash of forest plants) is transparent, as is a glaze fluxed with lead (usually "red" lead or lead tetroxide). Glazes fluxed with tin oxide, however, are opaque and white and are similar to a layer of paint.

Glazes can be colored via the addition of metallic oxides: cobalt produces grayish to bright blue; manganese, bright red-purple to purplish brown; antimony, yellow; copper, a blue, green, or bluish red; and iron, from pale yellow, to orange-red, to black. Uranium has been used to give brilliant shades of orange and yellow. The composition and uses of new kinds of glazes excited keen interest among potters. In the Near East, many potters kept and exchanged meticulous records of their experiments with different additives.

In China, the art of glazing took a different turn. Chinese pottery from the Sung Dynasty (960–1279 A.D.) was covered with a glaze made of ground feldspar, a vitrifiable silicate mineral later used in the manufacture of porcelain. Chinese potters also occasionally used a lead flux (lead tetroxide) in their glazes, but most of their stoneware was salt-glazed.

In the salt-glazing process, a shovelful of common salt (NaCl) was thrown into the kiln at its hottest point. The heat dissociates the salt into its sodium and chlorine components; the chlorine gas escaped out the chimney, but the sodium combined with silica occurring naturally in the clay, resulting in a smear glaze of sodium silicate over the body of the item. A salt-glazed pot has a pitted texture, like the peel of an orange. Adding a small amount of red lead to the shovelful of salt resulted in a smoother glaze.

The Assyrians first used glaze (possibly as early as 1100 B.C.) to cover decorated bricks. Opaque white tin glaze was probably first used to mask blemishes and discolorations in the main body of an object. (Most clays contain variable amounts of iron oxide that can change the color of baked clay in splotches from dark red to light buff.) Panels made of glazed brick have been found in the ruins of Khorsabad, Susa, Nimrud, and Babylon.

In the 9th century A.D., the art of tin glazing was revived in Mesopotamia and was spread to Morrish Spain by Islamic craftsmen. Sometime during the 13th century, tin-glazed ware came to Europe from the Middle East via Moorish Spain, but the technique was not perfected until the Renaissance. One of the main tin glazing craft centers in Italy was the island of Majorca (also called Maiolica), and a type of fine Italian ware became known as *maiolica* when merchants mistakenly attributed the technique's origins to the island. Maiolica became known for strong and vibrant colors and elaborate decorations done by some of Italy's best artists. The colorful style influenced the art of glazing all across Europe.

Tin glazing spread to the Faenza region in France near the Italian border, where the wares were called *faience*. Similar wares made in Germany, Spain, and Scandinavia went by the same name. In Holland, the tin glazing pottery industry centered around the town of Delft, leading to the name of *delft* or *delftware* for the Dutch version of this work. These types of pottery are world-renowned and still avidly collected.

Though it may seem that pottery is an ancient and primitive art, modern technology has introduced glazes using improved glass compositions that can withstand severe weathering or corrosive environments, or provide other desired material properties.

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For Additional Reading:
An interesting and easily found article on this topic appeared in the April 1990 issue of *Scientific American*. The article, "Ancient Glazes," by Pamela B. Vandiver, p. 106, also includes a short bibliography of additional sources.

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