manufacturing

How ceramic tile is made

Ceramic tile as we know it today has been around for several millennia. As technology progressed the manufacturing process was modernized, but overall remains the same. Ceramic tile is simply man-made stone so it should be no surprise that the production process mimics nature's manufacture of stone.

Biomimicry

Ceramics are composed mainly of three simple, natural ingredients:

Clay. The plastic or moldable base-material of a ceramic that allows it to be shaped.

Sand. The stabilizer that experiences shrinkage when the ceramic is baked or fired.

Feldspar. A common mineral with low viscosity when in liquid state fuses the body into one homogeneous piece as it cools.

Once the recipe has been selected, the first stage of production mimics the natural process of erosion by grinding all the material into regular, fine aggregates. Everything is loaded into a cement mixer-like machine called a ball-mill. This drum is filled with water and high-content feldspar balls that grind and pummel the mixture into even-sized particulates similar to the action erosion provides in nature.

Tile passes through an oven to ensure the glaze is hardened and able to withstand daily abuse.

Another machine, called the atomizer, was added to the process circa 1970 to better guarantee the consistency of modern tile. An atomizer uses a vortex of heated air and friction inside a silo to dry the slurry and chafe the particulates into little uniform spheres ready for pressing.

In nature rain carries layer after layer of eroded rock into river valleys in which the weight of each layer compresses the underlying minerals into solid rock after a few million years. This pressure is replicated in ceramic production at the presses. The main pressing techniques are dry-press and extrusion. Ceramic presses or extruders apply between 10,000 psi and 70,000 psi to mimic eons of pressure in the Earth's crust.

Extrusion

Clay contains between 16% to 18% moisture and is extremely plastic and moldable. Also known as the wet process, the ceramic material is forced under immense pressure through a steel die called the "press" or extruder, to create a long ribbon that is cut into tiles or trims. Extruded manufacturing is easily recognized by linear grooves or protrusions on the back and all trim pieces like chair rails or stair treads are produced by this method.

Dust-press

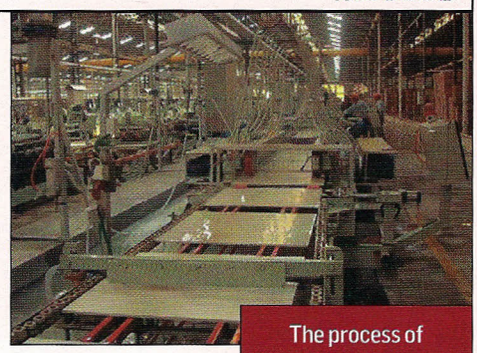
Referred to as the dry method, this process uses atomized clay with 4% to 6% moisture content. A high-pressure hydraulic press is filled with the nearly dry ceramic material. The fixed die at the top comes down with immense pressure to compress material into the desired tile size and shape. This is the most common production method due to the speed and precision afforded.

Digital glazing

The first inkjet or digital glazing machines debuted in Valencia, Spain, at Cevisama 2000. Patents have since run out on the technology, lowering prices and involving new minds in the evolutionary process. Consequently, digital glazing has been universally adopted throughout the tile industry due to the lowered cost of improved machinery.

Inkjet glazing operates in essentially the same way as your office printer. In a touchless glaze delivery system called drop on demand (DOD), screens no longer touch the surface of the unfired bisque. Digital image files also provide stone and wood looks, and unparalleled spontaneity. Imaging programs can split the master file into nearly countless screens for individual tiles. Aesthetically, this provides exciting opportunities for design professionals to specify the exact desired look in a higher performance material. Environmentally, it offers the opportunity to do so without extracting 2-million-year-old stone or killing a single old-growth tree.

The concept of a touchless glaze delivery has even bigger implications for the industry. Last year, it became clear the touchless advantage of digital glazing was at least partially responsible for the slim tile revolution during the past few years. The slimmer porcelains are even more delicate in their unfired state (greenware) than the traditional 10mm thick counterparts and traditional glazing methods would damage the unfired surface texture during glaze delivery. The advent of digital glazing has allowed limitless potential when decorating these delicate slim porcelains, creating both a technically and aesthetically revolutionary product.



The process of making tile has become extremely automated.

The original printer's limited size made large formats difficult but it is now possible for a new machine to apply glazes to tiles as big as 24 x 48 and some manufacturers are even creating larger, modified custom machines. The original three- and four-color machines are making way for new five- and six-color incarnations, creating deeper colors and higher resolutions. In fact, most new machines can achieve up to 1000dpi (dots per inch). HDTVs are 720 to 1080dpi to put this number in perspective.

Inkjet technology is better for everyone involved. Every manufacturer is looking for ways to reduce production costs in light of the troubled economy, not just for their own bottom line but for their price-conscious consumers. In a one-two punch, inkjet glazing also provides consumers with exactly what they are looking for in 2013: Unparalleled aesthetics, individual expression of style and good value.

Firing minerals

As each layer in the Earth's crust gets closer to the mantle, heat causes the minerals to fuse together into a new stone that is immutable once the process is complete. Roller kilns today emulate this process and fire ceramics at up to 2,200°F causing the feldspar to sinter, fusing with the sand and clay to create a new ceramic body.

The colors and patterns we see in natural stones come from minerals changing colors at different temperatures during the formation of the stone. Glazes operate in exactly the same way. They are all-natural minerals mixed with pre-fired or fritted glass to create a durable surface with nearly limitless color and pattern. Titanium oxides are used for whites, cobalt for blues and so on.