

CERAMIC TILE



Although ceramic tile's true origin and date still remain a mystery, it is safe to say that ceramic tile is one of the oldest forms of floor covering known to man. Discoveries of ancient ceramics, similar to modern ceramic tile, have been found on the banks of the Nile River in Egypt. Then its use spread to the Persians, Arabians, Spaniards, and Italians. The Italians soon became the masters of this industry, producing works of a religious nature, which have remained unsurpassed in history.

Italy, the world capital of ceramic tiles, has elevated the industry to the highest form of art. This nation, which has given the world countless art and architectural masterpieces, has added beauty, fashion, and design to the ancient product of ceramic tile. Today, ceramic tile is manufactured not only in Italy and Spain, but also in Mexico, the United States, and many other countries around the world.

The Definition of Ceramic Tile

Ceramic tile is simply a mixture of clays which have been shaped and fired at high temperatures, resulting in a hard body. This hard body may be left untreated, or it may receive a glazed wearlayer. To put it a different way, ceramic tile is nothing more than beautiful clay.

How Ceramic Tile is Made

The fundamental steps used in the process of manufacturing ceramic tiles have not changed in thousands of years. Mixing, molding, glazing and firing have always been the essential steps required in production. The major changes that have taken place in the ceramic tile industry are the automation of the modern factories. Today's highly sophisticated factories, utilizing the latest state-of-the-art technology, mass produce tiles at speeds unimaginable to their forefathers.

The ability to mass produce high quality tiles, while at the same time maintaining each tile's individual characteristics, has given the producers the ability to offer the individual homeowner a product that was once reserved for only kings and sultans,

Ceramic Tiles Composition

All of the raw materials that go into making ceramics come from the earth, including the colors of the glaze. This is a testimonial to the quality of the product. While man has been successful in finding ways to improve most products by substituting natural materials with synthetics, such as in carpet, he has not been able to improve on the quality of raw materials found in ceramics. They have basically remained unchanged for thousand of years.

Product Constructions and Materials

Glazed ceramic tile is made up of two parts: the body, which is called the BISQUE, and the surface, which is called the GLAZE. The ingredients used to make both the bisque and the glaze are all natural materials mined from the earth. The main ingredient is clay. Types of materials will vary from producer to producer, but could include such elements as quartz, kaolin, fritz, dolomite, cobalt, selenium, and talc.

Manufacturing of Single-Fired Ceramic Tile Mixing

1. Each shipment of raw materials is tested in the labs to assure quality.
2. The raw materials are weighed, measured, and mixed together in accordance to the producer's formula.
3. Then, the raw material is deposited into a large vat and mixed with water. The vat operates like a giant blender, breaking down the material while mixing it with water until it is the consistency of mud.
4. The mud is then pumped into a large dryer. At the end of the drying cycle, the material is deposited on a conveyor belt and transported to the production line. At this time the blended material is warm, very fine sand, containing about 8% moisture, which is needed for press molding.



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Molding

1. The sandy clay is fed into a steel mold and hydraulically pressed into different tile sizes and shapes. At this point, the product is called "green tile."
2. The "green tile" is then transported on a conveyor belt through a small dryer to remove the remaining (8%) of the moisture.
3. The "green tile" is inspected as it moves along the conveyor belt. All visually defective material is removed.

Glazing

After pressing, drying, and inspecting, the "green tile" passes through a glazing compartment built over the conveyor belt. As the product moves through, the liquid glaze can be poured or sprayed on. (This glazing looks like a miniature car wash)

Firing

At this point, the product is ready for baking. It moves into an oven, called a kiln, and is slowly transported through on ceramic rollers. The tremendous heat (over 2000 degrees F) in the kiln hardens the tile's body (bisque) and fuses the glaze. The size and finish of the tiles are controlled by the amount of heat and the time spent in the kiln.

Completion

At this point, the product is sent through its final inspection and graded for quality. The inspector's grading is based on surface blemishes, warpage, size, and general appearance. Once the tile is inspected, it is boxed according to its quality, loaded on pallets, and ready for shipment.

Ceramic Tile's Durability

P.E.I. Wear Rating System - To minimize the possibility of choosing the wrong product, most manufacturers use the P.E.I. guide to rate the durability of each tile. As shown below, the rating goes from Group I to Group V, with Group V being the most durable.

P.E.I. Wear Ratings:

Group I Tiles suitable only for residential bathrooms where softer footwear is worn.

Group II Tiles suited general residential traffic, except kitchens, entrance halls, and other areas subjected to continuous heavy use.

Group III Tiles suited for all residential and light commercial interiors such as offices, reception areas and boutiques.

Group IV Suited for all residential interiors and moderate traffic commercial applications.

Group V Recommended for all interior residential and commercial uses.

MOH's Rating Scale (Method of Hardness) -

The relative hardness of glazed tile is an important issue that should be addressed when selecting a tile. The test is performed by, scratching the surface of the tile with different minerals and subjectively assigning a "MOH's" number to the glazed. The softest mineral used is talc (a # 1 rating if no scratch), the hardest is a diamond (a # 10 rating if no scratch). Other minerals that provide MOH's values of five or greater are suitable for most residential floor applications; a value of seven or greater is normally recommended for commercial applications. Both abrasion resistance and glaze hardness should be addressed when considering using glazed tiles as floor products.

Break Strength - Ceramic tile used on floors and walls must be able to withstand the expected load bearing capacity of various installations. In order to determine the strength and durability of the tile, a standard test method is used to evaluate individual pieces. A force is applied to an unsupported portion of the tile specimen until the breakage occurs. The ultimate breaking strength is then recorded in pounds per square inch. Final selection of the tile should be based upon the breaking strength and the appropriate installation method.



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Coefficient of Friction - Tiles used on commercial and residential floors should provide a safe walking surface in wet and dry conditions. By measuring the coefficient of friction, a quantitative number can be determined. To determine this, a 50 pound weight is placed on a neolite heel and is pulled across the surface both wet and dry. The maximum amount of force (pounds) needed to initiate the weight is then recorded. This measurement is divided by the amount of weight (50lbs.) and referred to as the static coefficient of friction value. A rating of 0.5 is currently recommended by OSHA. The American Disabilities Act recommends a static coefficient of friction value of 0.60 for accessible commercial areas and 0.80 for ramps.

Facts About Glazed Tile

The glaze is a liquid that has been sprayed or pored onto the surface of the tile. It is then fused and hardened by the means of tremendous heat.

The colors of the glaze are made from a mixture of minerals such as gold, silver, zinc, copper, mercury, cobalt, and many others.

The strength and wear resistance of the glaze are determined by its hardness. The following factors affect the hardness:

Temperature - The higher the kilns (oven's) temperature, the harder the glaze.

Color - Dark color glazes, such as blacks and blues, are usually softer than lighter colored ones.

Gloss Levels - Shiny glazes are usually softer than matte or satin finished glazes.

Facts About the Clay Body (BISQUE)

The clay body, which is also called the bisque, is made up of various types of clay and other minerals. Combined, these raw materials give the bisque its strength and stability.

The strength of the bisque is also determined by its density. The strongest bisques, those suited for heavy commercial installations, have the smallest and fewest number of air pockets.

The density of the clay also determines whether the tile is suitable for outdoor use. Tiles that are too porous, absorbing more than 3% moisture, will freeze and crack if installed outdoors in cold climates.

The density of the tile is measure by the amount of water it absorbs. There are four types:

1. Non-Vitreous tiles absorb 7% or more of their weight in water and more and are suited for indoor use only.
2. Semi-Vitreous tiles absorb between 3% & 7% of their weight in water and are suited for indoor use only.
3. Vitreous tile absorb between 0.5% & 3% water and are suited for both interior and exterior use because they are frost resistant.
4. Impervious tiles, the strongest, absorb between 0% & 0.5% of their weight in water and are suited for both interior and exterior use because they are frost resistant.

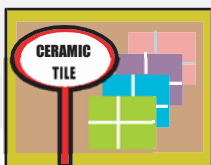
Types of Ceramic Tiles and Their Definitions

1. Glazed tiles are made the same way as unglazed tiles except that a glass wearlayer called a glaze is fused to its surface with tremendous heat.

2. Unglazed tiles are true inlaid. They are simply baked pieces of clay whose colors run throughout the body of the tile.

Features of Glazed and Unglazed Tiles:

Glazed Tiles - Many glazed tiles are not recommended for heavy commercial installations. They are generally suited for residential and light commercial use, although there are some exceptions. Technology for glazes has improved dramatically over the past few years. There are some new glazes on the market that are hard enough and durable enough for use in heavy commercial applications.



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Advantages of Glazed Tiles:

1. The glaze offers the manufacturers the ability to produce an unlimited array of beautiful colors and designs.
2. The non-porous glaze creates a smooth surface that is virtually stain proof.

Unglazed Tiles - This type of tile is the work horse of the industry. They are generally thicker and denser than glazed tiles. They includes such products as quarry tiles and porcelains. Generally, the color range of unglazed tiles is limited to the natural colors of the clay, ranging from light sand to red brick, but there are exceptions. Some manufacturers achieve a wide range of colors by mixing pigments in with the clay.

Two advantages of Unglazed Tiles

Unglazed tiles possess superior strength for heavy-duty commercial and residential use.

The rugged surface texture and matte finish of the unglazed tiles give them excellent "slip resistant" qualities for use in wet areas.

Description of Various Popular Tiles

Quarry Tile

Quarry tiles are unglazed tiles made from natural clays and shale. Their colors are usually limited to earth tones, ranging from red to light tan, although some manufacturers add pigments to the clay to offer a wider range of colors. Their body is both thick and dense, making them a popular choice for both heavy commercial and residential installations. Their surface generally has good slip resistant qualities.

Porcelain Tile

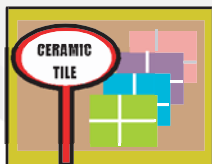
Porcelain tiles are made up of special clays and minerals similar to those found in chinaware. They come in a wide range of colors which are achieved by mixing pigments with the clay. The special clays allow the product to be fired at extreme temperatures (2,500 degrees F) resulting in a denser and harder body than most other tiles. They are highly stain resistant and strong. They can be produced with a plain, rough, polished or glazed finish. The combination of beauty and durability makes them ideal for heavy commercial residential installations.

Terra-cotta Tiles

Terra-cotta tiles are either handmade or machine made pavers. The machine made terra-cottas are much denser than the handmade tiles and can usually be installed outdoors as they are frost resistant. The most popular handmade tile is Saltio tile from Mexico. Saltio tiles are crudely made, varying widely in size, shade, and texture from one to another. Occasionally, they will even come with animal tracks on the surface. These handmade tiles are very porous and must be waxed to prevent staining and wear. The colors range from terra-cotta to yellow to brown. Additional colors can also be achieved by using stains.

Mosaic Tiles

Mosaic tiles are small tiles, less than 6 square inches in size. They come mounted on perforated paper sheets for easy installations. They are usually very dense products that are tough and stain resistant. Mosaics are ideal for shower floors because their small size gives them the flexibility to follow the contour of the floor as it slopes to the drain. The numerous grout joints also aid in slip resistance. The toughness and stain resistance also make them ideal for countertops. Note: While most quarry, porcelain, terra-cotta and mosaic tiles are unglazed, all of them can be produced with a glaze.



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Kathy Ireland Shades of America
Facts about Floor and Wall Tiles

1. Wall Tile

Any ceramic tile is suitable for walls, but the very thin, high gloss and decorative tiles are the most commonly used. The most popular size for wall tile is still 4" x 4", but there is a definite trend toward larger, more luxurious tiles. Wall tiles have very soft glaze and porous body and, therefore, should never be used on floors or for outdoor applications.

2. Floor Tiles

These tiles, glazed or unglazed, have the sufficient strength, impact, and abrasion resistance to withstand weight and foot traffic. They are usually thicker, denser, and heavier than wall tiles. If the substrate is strong enough to support the weight, floor tiles may also be used on walls and counter tops.

Various Gloss Levels

Glazed ceramic tiles vary in gloss levels depending on the look the manufacturer wants to achieve. It can range from a matte, to a satin, to a high gloss. Generally speaking, the higher the glaze the softer the glaze. Areas of the home that do not receive heavy wear, such as bathrooms, use a higher gloss level than the kitchen.

Ceramic Tile Usage

Throughout the ages, ceramic tile has been praised for its versatility of use. While carpet and vinyl are produced mainly for the floors, the area of usage for ceramic tile is limitless. The following is a list of areas where ceramic tiles are commonly used.

Walls (interior or exterior)

Patios

Floors

Fireplaces

Countertops and Backsplashes

Walkways

Pools

Exterior Trims

Many more,...

Sizes, Shapes, and Finishes of Ceramic Tiles

Sizes

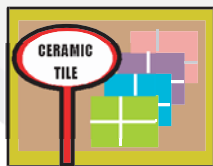
Floor tiles range in size from less than one square inch with mosaics up to 24" x 24". Although the most popular sizes in the United States for floor tile are still 13" x 13" and 12" x 12", there is a growing trend towards large tiles. The most popular wall tiles are still 4" x 4" and 6" x 6", but here again, there is a trend toward larger tiles such as 8" x 8" and 8" x 12".

Shapes

While square tiles still dominate the market, there are many other shapes available. They include rectangles, hexagons, elongated hexagons, octagons, and many more. Tiles also come in various shaped edges such as straight edges, scalloped edges, and cushioned edges that are heavily beveled to simulate handmade Mexican tile.

Finishes

Ceramic tile is also available in various surface finishes that include smooth surfaces, textured surfaces that simulate slate, stone, undulated surfaces that imitate handmade tiles, and gritty surfaces for slip resistance.



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Production Methods

Monocottura

Monocottura is an important term to know because many people relate it to quality. Monocottura is an Italian word meaning single fired. It is the newest method used to produce tile. The tile is shaped, glazed and fired in one process. The development of the Monocottura technology totally changed the industry for the better.

It dramatically speeds up production, resulting in a cost savings that is passed on to the consumer. Prior to the development of the Monocottura method, some tiles baked in a kiln (oven) for days. Today these tiles can be produced in less than an hour.

Monocottura tiles are not only produced more quickly, but they also have a denser body and harder glaze compared to previous methods of manufacturing. Single fired products are produced with a flat back which makes installation much easier than the old fashion button or lug-backed tiles.

Bicottura

Bicottura is an Italian word meaning double fired. The clay body is baked on the first pass, and the glaze is applied on the second. Actually, Bicottura may go through the kiln as many as four times. The pros and cons of Bicottura are as follows.

This double fired method of production has been replaced by the Monocottura method for making floor tile. Bicottura floor tiles are produced with lugs on the back, making installation more difficult. Bicottura floor tiles have a softer body and a weaker glaze than a Monocottura tile and are generally not recommended for outdoor use.

The Bicottura method is still considered by many the best method to use for making decorative wall tile because of the time and detail that is involved with coloring and decorating each individual tile. Note: There are other methods of productions which will not be discussed here because it would only serve to confuse the situation. Monocottura and Bicottura are by far the most common methods of production.

White Body vs. Red Body

White body and red body are terms that refer to the color of the clay body used when producing glazed tile. Many people have feelings that one is superior to the other, but this is not necessarily true. The quality of the tile has much more to do with the manufacturer and their quality controls than it does with the color of the clay.

Shading and Sizing

Shading

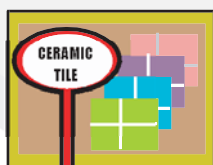
Many tiles, both glazed and unglazed are deliberately produced with a wide shade variation to enhance the beauty of the product and more closely simulate the look of natural stone.

A certain degree of shade variation is inherent in all ceramic tile. The manufacturers limit the amount of shade variation within a carton by sorting the tiles as they come off the production line. Manufacturers also mark the shade and run numbers on the carton.

To minimize any objectional shade variations, the installer should work out of several cartons at the same time. By doing this, they are able to effectively blend the tiles together. Most manufacturers will provide information that will display the relative shade variation that can be expected upon installation.

Sizing

The size of the tile will vary slightly. This is inherent with most tiles. Most manufacturers will keep sizing to an acceptable level by sorting the tile by size prior to packaging it. The grout joints will conceal slight variations. Some styles of ceramic tile are manufactured with a more rustic look, type of tile edge and size variation specifically designed to more closely resemble natural stone.



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mixes a smooth, crisp blue cotton shirt with a nubby corduroy pant and glen-plaid coat can be applied to the home as well---say, General Characteristics of Ceramic Tile

Abrasion Resistance

How will the glaze or surface hold up under continuous wear? This is a very important consideration when choosing any glazed floor tile. Commercial areas, as well as home areas subjected to heavy usage such as kitchens or foyers, demand good abrasion resistance. If the right product is chosen and properly maintained, that is, kept free of grit and sand, it could easily last the lifetime of the home. Note: Abrasion resistance is obviously not a factor when selecting an unglazed tile.

Water Absorption

The glaze on the ceramic tile is non-porous so when we refer to water absorption, it pertains only to the body of the tile. The absorption of the tile is important to know in order to make the right selection for outdoor use. If the tile absorbs more than 3% moisture, it is not suited for outdoor use in cold climates where it may freeze or crack.

Frost Resistance

Frost-resistance goes hand-in-hand with water absorption. The less water the tile absorbs, the high the frost resistance.

Stain Resistance

Ceramic material generally is the most stain resistant building product in the world. Glazed tile and even some unglazed tiles resist practically all solutions that could cause staining in other types of products.

Slip Resistance

The slip resistance of ceramic tile in ordinary applications is comparable to that of most hard surface flooring materials, and significantly better than some. Unglazed tiles have a great slip resistance than that of glazed tiles and are recommended for areas subjected to high water spillage. Many glazed and unglazed ceramic tiles feature an abrasive grit on their surface which can substantially increase their slip resistance. These tiles are particularly suited to public areas with direct access to the outdoors.

Color Permanence

While most colored materials will be altered by long exposure to light, colors in ceramic tile are unaffected and will not change or fade from exposure.

Dirt Resistance

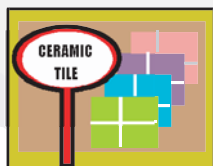
Ceramic tiles do not retain dust or residues. Plain water or a damp cloth is generally all that is required to keep the tile clean. With the exception of tiles such as terra-cotta, which may be oiled or waxed, no polishing or buffing is necessary to maintain the finish.

Fire Resistance

Ceramic tiles are completely fireproof at any temperature. They will not burn or feed a fire. Their surface will not alter, nor will they give off any toxic gases, smoke, or fumes during a fire. In addition to being fireproof, tiles have been found to provide protection for structural surfaces during fires.

Hygiene

The face of ceramic tiles will not retain liquids or absorb fumes, odors, or smoke, allowing for good hygiene. Tiles are suited for any environment where good hygiene is essential.



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