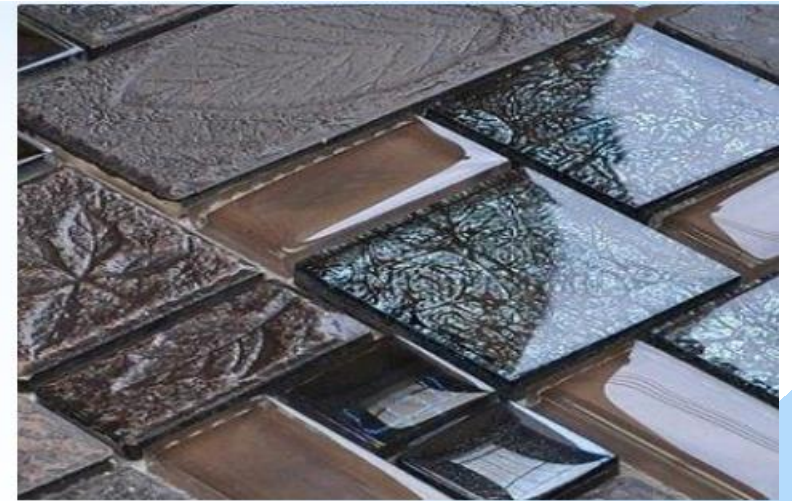


Ceramic and Stone Veneer Tiles Manufacturing

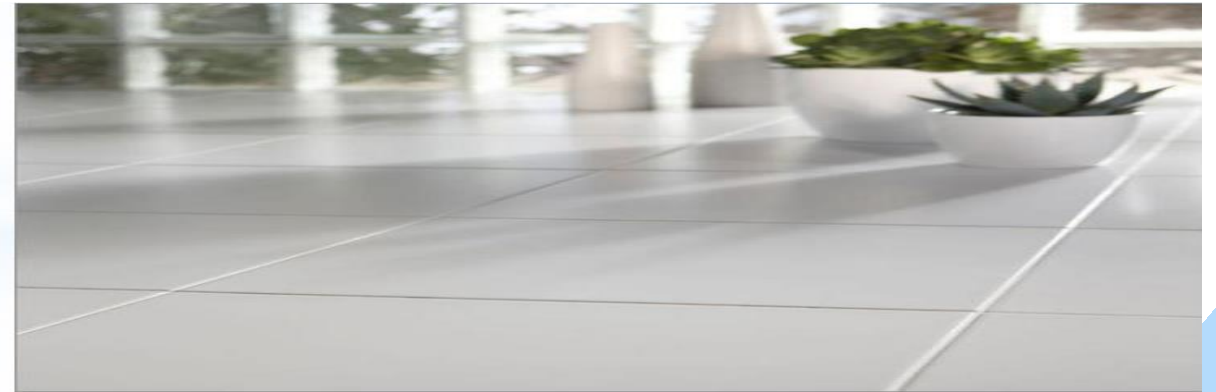
Introduction:

Ceramic tiles have been the most common and the most popular design that we can notice on every household or buildings. These decorative ceramic products have been used by humans long ago even during ancient times. The first documented indication and evidence of ceramic tile use were dated to the 13th century BC.



Raw Materials:

Most of the ceramic industry primarily manufactured floor and wall tiles because they're economical yet profitable and aren't complicated to make. The raw materials used in making these ceramic products are abundantly available in nature. Raw materials such as clay, feldspar, and silica are the main component in making ceramic tiles. These raw materials undergo site sampling and are examined to determine their elemental composition using X-ray. Chemical analysis are also determined to be able to formulate raw material ratio and proportion according to body properties and standards.



After the raw materials passed the initial examination and characterization of their individual properties, excavation follows. Each raw material is placed and stored in a separate storage area which is called stockyard and is labeled accordingly. Here, laboratory or quality control (QC) personnel will make sure that the properties of the newly quarried raw materials do not significantly varied with the existing individual raw material' properties. In case a significant difference is observed, a new ceramic body formulation will be made. Below are the main processes in the tile manufacturing industry.

The Manufacturing Process of Ceramic Floor Tiles & Wall Tiles:

1- BATCHING STEP:

The mixing of different raw materials at a specific ratio and proportion by weight is called batching. Prior to the utilization of these raw materials for batching, moisture content (MC) is determined to obtain the dry weight of each raw material. Heavy construction equipment such as backhoe payloader is used in moving and mixing these raw materials into certain mixing storage. Prior to that, individual raw materials are stored on their corresponding storage for batching. Initial comminution or preliminary particle size reduction.



1) Stock Yard;
(2) Specific
Storage for
Batching

2- BALL MILLING STEP :

After batching, the mixed raw materials are transported to ball mill via conveyor and are added with a calculated and measured amount of water, then blended, homogenized, and grinded by means of alumina balls (or ceramic pellets) for hours to form a slurry. There is an initial grinding period for this process, but no definite grinding duration. The endpoint of this process is when the standard properties of the resulting slurry such as the density, viscosity, and particle size are achieved. QC personnel will obtain samples right after the initial grinding period to determine these properties using specific laboratory equipment. This procedure will be repeated until the standard properties of the resulting slurry are attained.



- (1) Ball Mill;
- (2) Alumina Balls

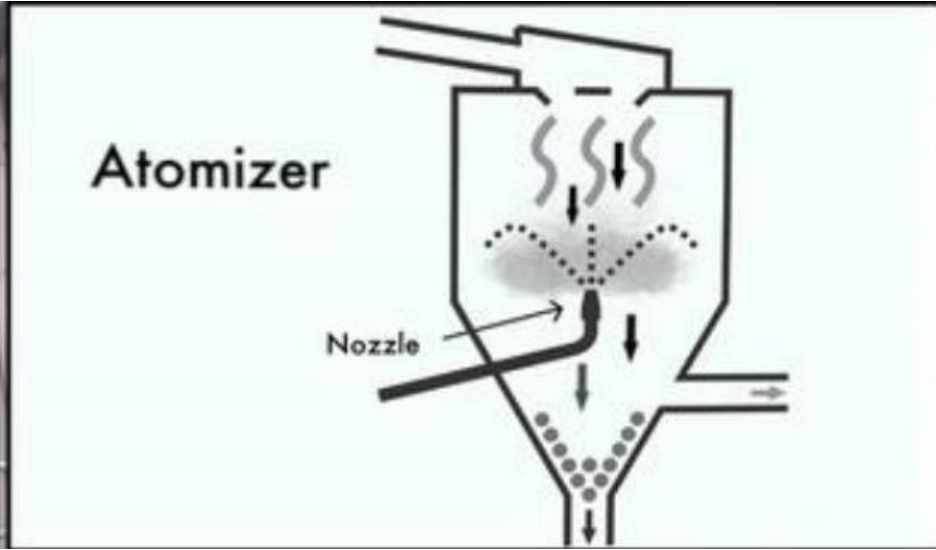
3- AGING STEP :

The slurry is then transferred and stored in a large cylindrical storage tank called a slurry tank. The slurry is then aged for 24 hours prior to its utilization in the next process. Inside the slurry tank, continuous agitation (scientific work for mixing) of the slurry involving the constant rotational speed of the mixing paddle is observed. This is to make sure that the slurry is continually homogenized during the aging period .



4-SPRAY DRYING STEP :

After aging the slurry for 24 hours, the mixture is then fed into the atomizer or most commonly known as the spray dryer(SD). The spray dryer is equipped with nozzles that spray the slurry into hot air to produce the powder. Again, QC personnel determined the powder's %MC and grain size for the SD operator to be able to adjust the nozzle spraying rate and hot air temperature to produce a powder with standard properties. The resulting powder is stored inside certain storage called a silo tank. The powder is cured for 12 to 24 hours prior to its utilization in production.



- (1) Spray Dryer;
- (2) Inside SD or Atomizer

5- DRY PRESSING STEP :

The main manufacturing procedure of these ceramic tiles initially starts during pressing. The preserved powder inside silo tanks is transported into pressing machines' steel boxes via conveyor. From the steel box, the precise amount of powder is evenly fed into the press machine's mold. As the powder had remaining moisture content, a certain pressing force is applied to form an initial solid unfired ceramic body called green tile with a specific length, width, and thickness. Again, QC personnel will make sure that the standard measurements correspond with the set standards.



- (1) Steel Box;
- (2) Press Machine;
- (3) Transporting to Preheating

6- PREHEATING (DRYING) STEP :

After the initial ceramic body or the green tile is formed, it simultaneously undergoes preheating or drying at 100-400 degrees Celsius for a period to remove the remaining moisture or the mechanically bond water. This process is necessary and is very important for the green tile to be stable and not experience thermal shock which will result in breakage during the firing process inside the kiln. This will also make sure that the resulting products are strong, durable, and are free of defects.



- (1) Inlet Preheating;
- (2) Continuous Preheating Furnace

7- GLAZING STEP :

The glazing procedure happened after preheating process. Glazes are primarily made of silica and feldspar and are glass like substances that act as a vitreous coating to ceramic tiles. Glazes are primarily for decorative purposes only however glazing also covers up the pores of the tiles after firing since glaze vitrifies which could also contribute hardness and durability of the resulting product. Glazes are usually applied to green tiles either by roller glazing, spraying, waterfall, dipping, screening, or dry glazing method. Again, QC inspects gram per tile glaze to prevent the variation of glaze colors after firing.



- (1) Roller Glazing
- (2) Spraying;
- (3) Water Fall

8- FIRING STEP :

Firing is the most vital procedure in the entire ceramic tile manufacturing process. So after the tiles are applied with glaze, a continuous firing procedure follows inside the kiln. There are different types of kilns, but the most appropriate and the most efficient kiln for tile manufacturing is the roller hearth kiln or RHK. The RHK is a type of continuous firing kiln with ceramic rollers, which transport ceramic tiles at different firing temperatures with uniform temperature distribution. Usually, the temperature at the inlet of the RHK does not vary significantly with the outlet of the preheating furnace and the RHK's temperature is usually highest at its 3rd quarter's section. The temperature of the RHK's outlet also controls to prevent thermal shock which may result in the breakage of the resulting tiles.



- (1) Roller Heart Kiln or RHK;
- (2) Inlet of RHK

9- SORTING AND PACKAGING STEP :

At this point, technically, have produced ceramic tiles out of raw materials. After firing, the tiles are transported into the quality assurance department using the forklift for manual inspections. Here, the tiles are manually checked for defects. Although there are already machines that automatically detect these defects, manual checking is still practiced since most defects such as “chip off” occurred during packaging. Sorting and packaging of ceramic tiles then followed. Ceramic tiles are sorted based on the variation of colors and size. A variation of the color of final glaze can happen since glaze nozzles sometimes encounter clogging problems while RHK temperature varies through time. Once the tiles are packed, they are placed in a warehouse for shipping.



- (1) Quality Assurance and Sorting;
- (2) Packaging;
- (3) For Shipping

Ceramic tiles manufacturing process - How it's made?

افلام فديوية عن صناعة البلاط السيراميك

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1- What are ceramic tiles used for?

2- Is porcelain a ceramic?

3- What are the types of ceramics?

4- Which is easier to clean porcelain or ceramic tile?

5- Can ceramic crack?

6- How can I tell if my tile is ceramic or porcelain?