

CERAMICS INDUSTRY COLOR CONTROL MEASURING AND CLASSIFYING OF TILES



Overview

Manufacturing of ceramic and homogeneous tiles have undergone considerable changes in recent times. Many processes and methods of producing ceramic tiles have been automated to achieve better quality.

Types & Characteristics

Ceramic Tiles

Ceramic tiles were once handmade from a mixture of clay along with water and then dried in the sun or fired in brick kilns. In the modern world, majority of ceramic tiles made today go through a process which require lesser time and labour. Special clays mined from the earth are shaped, coloured and then fired in kilns. They can be coloured and glazed to produce a high gloss or matte finish. Most ceramic tiles comes either with a white or red body color underneath the glazed finish.

Homogenous Tiles

These tiles composed of fine porcelain clays which are fired at a much higher temperature than the ceramic tile. The process of making homogenous tiles causes it becomes harder, denser and less porous which makes it is less prone to moisture and stain absorption than the ceramic tiles. As such, homogenous tiles are suitable for both indoor and outdoor usage. However, they are much harder to cut due to their density and hardness.

Glazed Tiles

The word “glaze” comes from the old English word for glass which is a good description of glaze. Not every tile has to be glazed to be considered a ceramic. It may be coated with or without a glaze depending on its intended purpose. Firstly, glass-forming minerals or glaze is usually baked into the surface of the clay at extreme high temperatures. Once glaze is applied, these tiles can be used for kitchens, pantries and restroom settings such as backsplashes, countertops and bathroom walls. The main features of glazed tiles are ease of cleaning and stain protection.

Rectified Tiles

The edges of rectified tiles are mechanically cut to size and finished after the firing process to achieve precise dimensions. Unlike typical factory edged tile, rectified tile has precise 90 degree angle with smooth edges which can be laid with consistency.

Tile Quality

To minimize quality problems, tile manufacturers need to establish a quality control system to reduce the impact of poor workmanship such as:

- Shade variations
- Tile size variation
- Warpage
- Water absorption, surface cracks and damage



Shade Variations

The deviation in color, texture and tone between individual tiles is called shade variation. It is an inherent characteristic of inconsistent production run. During the production process, there are many variables that can affect the tile shade such as material colors, mixing quantity, firing conditions and other decoration effects. Manufacturers can achieve the ideal shade for each product if they can control the different variables extremely well. In most cases, however, such control is almost impossible and manufacturers instead deal with the reality of classifying and sorting of tiles by shades to maximize their profits.

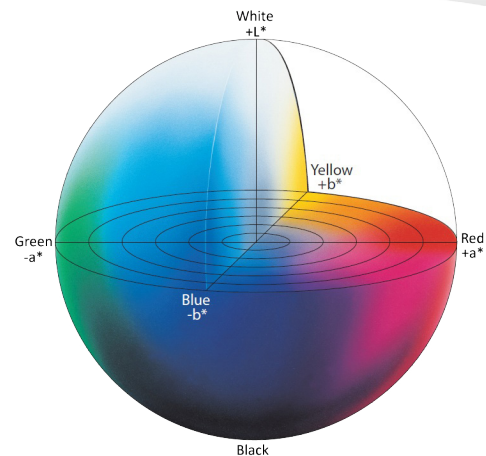
Classifying & Sorting

This process is not easy and many problems occur which can lead to customer returns, damaged reputation and lost sales. They include:

- Difficulty in establishing and controlling shade groups.
- Manual inspection is inconsistent where accurate shade decisions cannot be determined against established shade groups.

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- Tiles within the same shade group have large visible difference due to incorrect inspection or defined shades being too broad.
- Many different shades exist leading to high storage, distribution and sales costs.
- Many tiles fail to fit within the established shades and had to be re-established and classified into another quality category.



Ways To Overcome

In the ceramics industry, color differences are important amongst other parameters and should be controlled. Spectrophotometers and chroma meters (color measurement devices) are instruments suitable for controlling small color differences. Measurement can be taken from the spectrophotometer with a wide range of wavelength and optical geometry which matches with The Commission Internationale de l'Eclairage (CIE) recommendation. CIE is an organization known for their works in color science, and specifies the use of color spaces to make color data easier to quantify.

In general, CIE L*a*b* (CIELAB) is the most complete color model and is used conventionally to describe all the colors that are visible to the human eye. Tile shade sorting can be performed by:

- Taking objective measurement with a color measurement device that corresponds with human perception. This device uses an integrating sphere for illuminating the tile surface with one or more light sources of controlled intensity and collect the reflected light from the tile surface and convert it into digital signals with the help of a digital processor.

- The digital processor will then analyse and compute reliable and repeatable measurement values.
- Colors can be separated into bright and dark colors when their lightness is compared. The L value represents the amount of lightness. As the L value increases, the sample becomes lighter until it reaches white (L=100). A positive "a" value represents increasing red, while a negative "a" value represents increasing green. Likewise, an increasing yellow is represented by a positive "b" value and a negative "b" value for increasing blue.

Conclusion

From wall tiles to floor tiles, color measurement devices have become an absolute necessity and are widely used to establish and meet color quality standards for the tile manufacturing industry. These instruments allow users to accurately evaluate and control the color and appearance of tile specimens with various surface conditions, opacity and thickness in a more streamlines process. Whether it is internally or throughout the supply chains, color consistency can be maintained and quality standards can be met with lesser time and effort.