

THICKNESS

Ceramics have different thicknesses depending on their use:

- Thicknesses **3–5 mm** are extra-thin ceramic tiles, mainly used for **wall coverings**, although they can be used in some floors. Technologically very advanced products, highlight its flexibility and lightness.
- Thicknesses of **9–10 mm** are the standard size for the vast majority of ceramic tiles. They are the ones that will be used in most **interior design and decoration projects**.
- Thicknesses of **20–30 mm** are mainly used for **exterior surfaces** with a large number of people, such as shopping malls, public swimming pools, beaches, etc.

WATER ABSORPTION (E)

The porosity of ceramic tiles is expressed by the percentage of water absorption over the total weight of the tile. A high water absorption value indicates high porosity, while a low value indicates low porosity. For this reason, tiles with low water absorption should be **used in humid areas**.

- Very low water absorption: **$E \leq 0.5\%$** .
- Low water absorption: **$0.5\% < E \leq 3\%$** .

ABRASION RESISTANCE (PEI)

The Porcelain Enamel Institute (PEI) rating system is designed to measure the durability and suitability of ceramic tiles for different levels of traffic and wear.

- **PEI 1 Very Light Traffic:** Areas of the residential dwelling where there is not a lot of traffic such as bathrooms.
- **PEI 2 Light traffic:** For domestic living spaces away from outdoor areas such as the bedroom.
- **PEI 3 Light to moderate traffic:** Domestic facilities with higher traffic such as kitchens, living rooms, hallways and corridors.
- **PEI 4 Moderate to heavy traffic:** Suitable for high pedestrian traffic areas, including commercial floors, restaurants and anywhere else where traffic is caused by human feet.
- **PEI 5 Heavy traffic:** Designed for pedestrian areas such as shopping malls, industrial galleries and public spaces or areas where traffic may be caused by elements other than human feet.

SCRATCH HARDNESS (MOHS)

The scratch resistance of the material's surface is measured using the MOHS scale, the hardest surfaces are rated at grade 10 and the softest at grade 1. A hardness of **6 provides some assurance of scratch resistance** in medium and high traffic screeds.

BREAKING STRENGTH

This refers to the ability of the ceramic tile to support weight during use, determining the bending strength or modulus of rupture. According to the values:

- Walls **>450N**
- Pedestrian traffic floors **>900N**
- Road traffic floors **>2000N**

CHEMICAL RESISTANCE

Ceramic products are subjected during their use to contact with different chemical agents: cleaning products, foodstuffs, water (liquid or steam), etc... It's determined with the following values:

- **Class A:** No visible effect
- **Class B:** Visible appreciable change in appearance
- **Class C:** Partial or complete loss of the original appearance of the surface

STAIN RESISTANCE

Measures the resistance of a surface to stains and a classification is established to determine irreversible changes in appearance. This classification ranges **from class 1** when the stain persists **to class 5** when the stain is removed with hot running water and blotting with a chamois cloth.

FROST RESISTANCE

Frost resistance is directly related to the porosity of the ceramic material, since the penetration of water into the pores and its subsequent expansion due to freezing can lead to breakage of the tile or chipping of the glaze. For the ceramic material to be considered frost resistant, it must have a **water absorption of less than 3%** and pass the ISO test.

SLIP RESISTANCE

Used to classify the slip resistance properties of ceramic flooring products. Depending on the test, different scores are established:

- **R9:** Slip resistance up to an angle of inclination between 3° and 10°.
- **R10:** Slip resistance up to an angle of inclination between 10° and 19°.
- **R11:** Slip resistance up to an angle of inclination between 19° and 27°.
- **R12:** Slip resistance up to an angle of inclination between 27° and 35°.
- **R13:** Slip resistance up to an angle of inclination greater than 35°.

DCOF is the Dynamic Coefficient of Friction, used to identify the most suitable ceramic products for floors. Especially if the floors may be subjected to wet exposure. The standard requires ceramic flooring products to have a DCOF of **0.42 or higher** if their use in a level outdoor or indoor space intended to be walked on when wet.

SHADE VARIATION

Shade variation describes the **degree of color and texture variation** in different ceramic tile pieces of the same product. Often the terms range from V1 to V4 but it's a subjective scale. Higher value, higher shade variation.

- **V1 Low variation:** Have minimal variation. They provide a uniform appearance. They are usually used in spaces where a homogeneous look is desired, such as modern and minimalist designs.
- **V2 Moderate Variation:** They have slight variations, but the differences are relatively subtle. Variations are deliberate and create a natural look, suitable for spaces where some visual interest is desired without extreme contrast.
- **V3 High Variation:** They exhibit noticeable variations in color, hue and texture. These variations are more pronounced and can contribute to a more dynamic and visually appealing aesthetic. They are often used to create a more rustic or natural look, both indoors and outdoors.
- **V4 Random Variation:** They have a random and substantial variation in color, tone and texture. The differences from tile to tile are intentionally pronounced and can resemble natural materials. They create a visually striking effect and are often used for designs that emphasize a rich, organic look.

INDUSTRY STANDARDS INFORMATION:

- **ASTM** AMERICAN SOCIETY FOR TESTING AND MATERIALS
- **ISO** INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
- **EN** EU INTERNATIONAL ORGANIZATION FOR EN STANDARDIZATION
- **DIN** GERMAN INSTITUTE FOR STANDARDIZATION
- **ANSI** AMERICAN NATIONAL STANDARDS INSTITUTE

The American Society for Testing and Materials (ASTM), the International Organization for Standardization (ISO), German Institute for Standardization (DIN), American National Standards Institute (ANSI) and the EU ISO are internationally recognized organizations that identify industry test methods and technical standards. All tests are subject to change based on new studies and standards may vary across different industry procedures.