

Optical Hazing on Polished Porcelain Tiles

This effect is not a new phenomenon; it has occurred in natural stone and painting industry for decades and has been used by the photographic industry for over a hundred years.

So what is optical hazing?

How does it present itself and what causes it?

Firstly it will present as a smoky, hazy, smudgy type of finish on the surface of porcelain tiles. It will only be visible when a direct light source reflects at a certain angle across the surface of the tile

It is caused by light. If a ray of light could be observed approaching and then reflecting off a mirror, the behaviour of that light as it reflects would follow a predictable law known as the law of reflection.

A ray of light approaching a mirror is known as the **incidence ray (I)**. The ray of light which leaves the mirror is known as the **reflected ray (R)**. The law of reflection states, “that the angle of the light rays striking a surface is equal to the angle of the reflected light” (see **figure 1**).

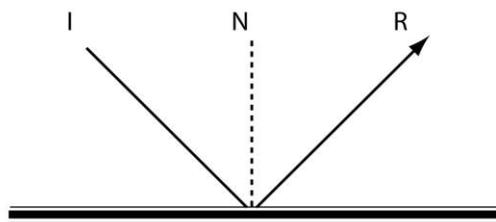


FIGURE 1

If reflected light is so predictable, then why does it reflect differently off different types of surfaces?

Reflections off a smooth surface such as a mirror or calm body of water is known as specular reflection (see figure 2).

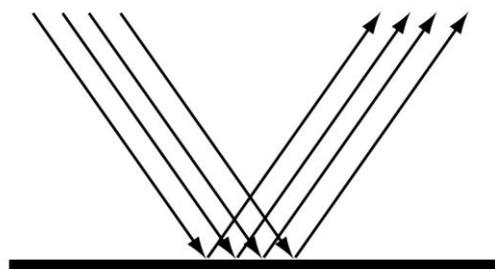


FIGURE 2

Reflections off a rough surface such as clothing, paper and ceramic tiles is known as diffuse reflection (see figure 3).

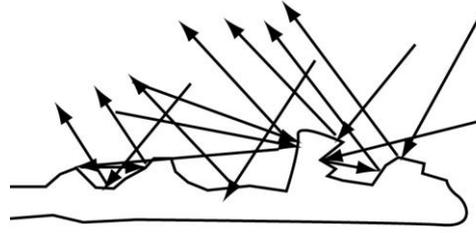


FIGURE 3

Whether the surface is microscopically rough or smooth has a tremendous impact upon the subsequent reflection of a beam of light. A beam can be thought of as a bundle of individual light rays which are travelling parallel to each other.

Each individual light ray of the bundle follows the law of reflection. When the bundle of light rays strikes a smooth surface then the light rays reflect and remain concentrated in a bundle upon leaving the surface (**Fig 2**). On the other hand, if the surface is microscopically rough, the light rays will reflect and diffuse in many different directions (**Fig 3**).

Many consumers have expectations that their polished porcelain floor is going to have a mirror like finish. A polished porcelain tile is not a mirror. When the surface of a polished porcelain tile is examined under significant magnification, small micro facets are always found. Light that strikes such micro facets reflects in a diffused manner giving a “Halo” or “Haze” effect.

The level of gloss achieved on the surface of a polished porcelain tile is dependant on many factors. In order to achieve the designs the market wants, manufacturers have to play around with the recipe mix for the tile. As a result a wider range of minerals and colour will be introduced into the clay mix. However, just like natural stones, some polished porcelain tiles will not be capable of taking a higher polish.

The amount of haze visible depends on several factors, for example:

- The number of light sources and their positions i.e. a single source of light would mean there would be a limited number of positions available to observe any haze. The same surface when lit by a number of light sources will increase the amount of haze visible because there are more opportunities to see the reflected light. Another example is bulk sunlight shining through large windows and doors early in the morning; the large volume of sunlight will increase the amount of “Haze” visible.
- The size of the clay particles and other ingredients of the tiles can also have an effect on the amount of haze visible.

“Optical Haze” on polished porcelain tiles is **not** related to cleaning or wax residue problems. It is an inherent characteristic of the tiles stemming mainly from the mineral content and their manufacture. It has no effect on the technical performance of the tiles.

So is Optical Haze a defect?

In short, no. It is not something British Standards require to be tested. It is generally only visible in low angles of reflected light and is primarily an aesthetic issue.

It is worth restating that polished porcelain tiles are not mirrors.