

Resumen ponencia 101

Optical hazing in polished porcelain tiles: Measuring, thus defining, controlling and defeating a defect

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There has been much debate throughout Australia as to whether optical hazing of polished porcelain tiles is a defect or an effect. Professional independent tile experts consider optical hazing to be a defect, as do bitterly disappointed consumers.

What is optical hazing? Haze is light that has been reflected by small surface structures adjacent to the main specular component. We often only perceive optical hazing from a distance when there are low angle reflected light viewing conditions. We do not see the hazing from directly above so the standard method of detecting aesthetic defects is redundant. Optical hazing typically appears as a milky or cloudy finish; there may also be a loss of reflective contrast and lights are reflected with multiple halos. When first observed, the overall impression is that a part of the floor has a smudge and is dirty. Many optical hazing cases have been referred to cleaning experts. The only remedy is to mechanically repolish the tiles in situ, where there have been many failed attempts.

Optical hazing of technical porcelain tiles is principally caused by isolated problems in the industrial polishing process that often occur unexpectedly. As such, the percentage of affected tiles that get packaged depends on how long it takes for somebody to recognise and fix the problem. Optical hazing is unlikely to be recognised on the production line as quality control staff typically view tiles at an angle and under lighting conditions that are unsuitable for detecting hazing. While only a small percentage of defective tiles might be packaged, the current problem is the uncertainty as to which batches might contain affected tiles. The failure of manufacturers to identify these defective tiles means optical hazing is unlikely to be detected until after the tiles are installed. It is unrealistic to expect merchants, customers or tile fixers to lay out whole batches of tiles in order to carefully inspect them under appropriate viewing conditions before sale or before laying commences. Manufacturers require new in-line quality control equipment.

Some polished tiles have been finished using a nanocoating, where this might be assumed to provide the tiles with stain protection, although it might also be used to fill the pores in 'porcelain' of questionable porosity, as well as any microcracking induced by an inappropriate choice of processing conditions. However, if the tile is covered by a waxy coating, any optical hazing is likely to remain undetectable until after the tiles have been installed. The tiles obviously need to be reliably inspected prior to coating.

Tile fixers cannot be made for quality control as they will rarely install tiles under circumstances where the optical hazing will be detected.

Although some manufacturers use glossmeters as a quality control measure, these instruments are insufficiently precise: too much light is internally refracted within the glass component of the tile surface. The only realistic option is to install appropriate artificial vision equipment at the end of the polishing train in order to detect any problem as soon as it has occurred.

The Department of Civil and Industrial Engineering at the University of Pisa has conducted extensive research into the optical phenomena associated with the polishing and surface modification of stones, using several different analytical techniques. This theoretical understanding has led to various prototype devices, the granting of patents, and now the commercial development of a novel scanning reflectometer, with a model for use on production lines and another for use in the plant or laboratory.

Now that we can measure optical hazing, we should be able to reach a consensus as to what is unacceptable, so that we can develop acceptance standards, possibly based on quality classifications. Since the reflectometer can be used to control and optimise

polishing processes and effectively correlates surface roughness and reflectance, it might also have some potential applications with respect to slip resistance assessments.

Key words: optical hazing; polished porcelain; reflectometer; process control