

## An Education in Crystallization

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Crystallization or vitrification) is a method of creating a gloss on calcium bases floors (marble, limestone and travertine). Crystallization has been used since the 1960's with varying levels of success and continues to be a controversial topic among stone care professionals.

### What is Crystallization

Crystallization is a process in which a steel wool pad is used in combination with a weighted floor machine and acid solution to bring a polish to stone floors. The most common ingredients of crystallization chemicals are acid, magnesium fluorosilicate and water.

In this reaction the magnesium salts are primarily left on the surface of the stone and removed during the next cleaning of the surface, and the calcium fluorosilicate (CaSiF<sub>6</sub>) is bonded to the underlying stone and is now the layer we walk on.

The surface of the stone has now been chemically altered and there is no way to reverse the process. Note that this new surface of the stone is not a coating but is now part of the stone itself. The only way to remove a crystallized layer is through mechanical action such as diamond honing with diamond discs or the SRDS' (scratch removal discs). Chemical strippers commonly used to remove acrylics will not remove crystallization

The resulting layer of calcium fluorosilicate formed on the surface of the stone is harder, glossier, and more stain resistant than the original stone surface. This is the principal behind crystallization.

### The Great Debate

Both sides have put forward convincing arguments. If you opt for crystallization, as with any process, strict monitoring is necessary. The Marble Institute of America neither condemns nor endorses this process.

The crystallization process consists of spraying a liquid onto the marble floor and buffing it in with steel wool under a standard speed floor machine. The steel wool generates heat through abrasion and the chemical reacts with the marble, producing a new compound on the surface of the stone.

Almost all crystallization chemicals contain two main ingredients: acid, fluorosilicate compounds and sometimes, waxes or acrylic polymers.

Crystallization can only react with calcium-based stones such as marble and limestones. Although the process can work on non-calcium based stones such as granite, the reactions are entirely different. In the chemical reaction, acid attacks the calcium carbonate of the stone, leaving an etch mark on the stone surface.

When the crystallization liquid is sprayed on a marble surface, the acid attacks the calcium carbonate. The fluorosilicate compound then attaches itself to the calcium ion, forming a new compound called **calcium fluorosilicate**.



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Simply put, the crystallization process works by forcing one ion from one molecule to another in the cement matrix that holds the crystals together. This forms a new cement matrix that can be harder than the original cement matrix of the stone. The newly hard and the preexisting softer structures form two layers, and thus a layer of separation is between them. In many stone varieties, especially those that contain carbon elements, this causes the stone to delaminate. In others, especially many low and medium density limestones, this causes iron (from the steel wool) to enter into the stone's chemistry. All stones that undergo this process have dramatic changes in their element construction. In order for this reaction to take place, frictional heat must be generated. This is the reason for using steel wool on the buffing machine.

The process must be performed by trained operators' who are familiar with the techniques of this process. Excessive moisture in the stone can hamper the crystallization reaction and cause problems.

Proponents of the crystallization process claim the new compound formed protects the surface of the stone, adds shine, and may even harden the stone, increasing its wear resistance. Opponents of the process claim that the new compound formed blocks the stone's ability to "breathe," traps moisture, and causes the stone to rot. It is important to note that there are many different formulations of crystallizers that vary in chemistry and performance. It is imperative to qualify the stone and match an appropriate formulation of crystallizer to achieve the desired result.

#### **Question:**

What is the best way to maintain polished marble and terrazzo floors?

#### **Solution:**

There are many opinions when it comes to the best way to maintain polished marble and terrazzo floors. With regards to what is best, no one should claim – or can claim – such. One of the most popular methods is crystallization. Before we delve into this topic, let us first review some points:

- The first crystallization product for maintaining polished marble and terrazzo was developed in the 1960s by Jorge Riera More', who owns a company in Barcelona, Spain, named Coor & Kleeever.
- The Coor & Kleeever crystallizer contains no wax, and has been used for decades to maintain polished stone surfaces in many of the finest casinos, resorts, homes and public buildings around the world.
- The process is designed as a safe maintenance procedure to remove the light wear patterns, created by foot traffic, in the polished surface.
- This is achieved by chemically transforming microns of the surface from calcium carbonate to calcium fluorosilicate.
- Laboratory tests have proved that this chemical transformation creates a more-durable finish, thus enabling the polish on marble to last longer under foot traffic.

A large part of the success that crystallization has seen over the decades is due to its ease of use and production as compared to alternative methods of maintaining stone surfaces. However, just because something is easy, does not provide enough merit for use.



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With that being said, I'll attempt to provide you with the benefits and drawbacks of this widely accepted process.



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## WHEN AND WHERE TO USE

To begin with, there is no one product or process that is the be-all and end-all to maintaining polished marble & terrazzo. Crystallization is simply one method of many that may or may not be the application of choice depending on the floor. Obviously, you would not want to use crystallization on a honed, non-reflective surface. This process is meant only for **polished** surfaces. If you are confronted with maintaining a large polished marble or terrazzo floor with high foot traffic, an excellent way for maintaining this polish, more times than not, will be crystallization.

Keep in mind that, today, some crystallizers contain wax. This can create a build-up on the stone surface over time. When this happens, you will need to use an alkaline detergent, recommended by a professional in the industry, to remove this build-up. If the alkaline detergent does not remove the build up, then you will need to use diamond abrasives to remove the build-up before continuing the maintenance program.

There are proven crystallization products in the market place that contain zero wax. To find one of these no-wax crystallizers you can simply research the marketplace, find a company who claims their crystallizer contains no wax and have it analyzed. Then, you can be confident you're on the right track to using the correct product.

Crystallization product with no wax will take much longer to create a build-up. If a build-up does eventually occur it will be from the chemical reaction, which we discussed earlier.

A proper maintenance program should not allow the crystallization to build up on the stone surface. If you begin to see a build-up when using a no-wax crystallization product, you're attempting to use the product in a way that it was not intended to be used.

This is a maintenance process, not a restoration process. By overusing a no-wax crystallizer and allowing it to build up on the surface, you're pushing the product to remove deeper scratches in the surface that it cannot remove. This type of damage should be removed by restoring the floor with diamond abrasives.

Another popular method of maintaining polished marble is the use of powder/paste compounds, which contain oxalic acid or potassium oxalate, among other ingredients. Here, you're attempting to recreate what happens in the stone processing factories around the world.

The factories polish most marble in a polishing line, running the material through a series of abrasive stones. The final polish is achieved by using something such as a 5X brick; this brick's main ingredient is oxalic acid or potassium oxalate.

The factory polish is created by chemically transforming the marble surface with the acidic slurry from the 5X brick. This transformation changes microns of the surface from calcium carbonate to calcium oxalate.

Maintaining polished stone surfaces with oxalic acid compounds usually provides great results and is a widely accepted method. However, these types of products may have adverse effects on green and maroon stones. These compounds will also begin to build up on the surface if overused.

In many cases, the buildup occurs quicker than crystallization. Also, when compared to crystallization, the process can be slow and messy.



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## FULFILLING THE NEED OF THE CUSTOMER

We all know that it's impossible for the factory polish on marble to last forever under foot traffic. Therefore, these methods were created to fill a need for those who wanted a solution to their problem.

Both crystallization and oxalic acid compounds achieve very similar results. Both create a chemical transformation, and both achieve a high degree of reflectivity on the stone surface. Depending on the situation, one may be better suited than the other.

But no one process is best for everything. These two methods are only portions of a maintenance program for polished stone surfaces. In the end, when looking for a complete maintenance program for natural stone, I would suggest that you ask for name brands proven to be successful with decades of documented historical evidence, and backed by trained, qualified people or firms familiar with stone and the stone industry.



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