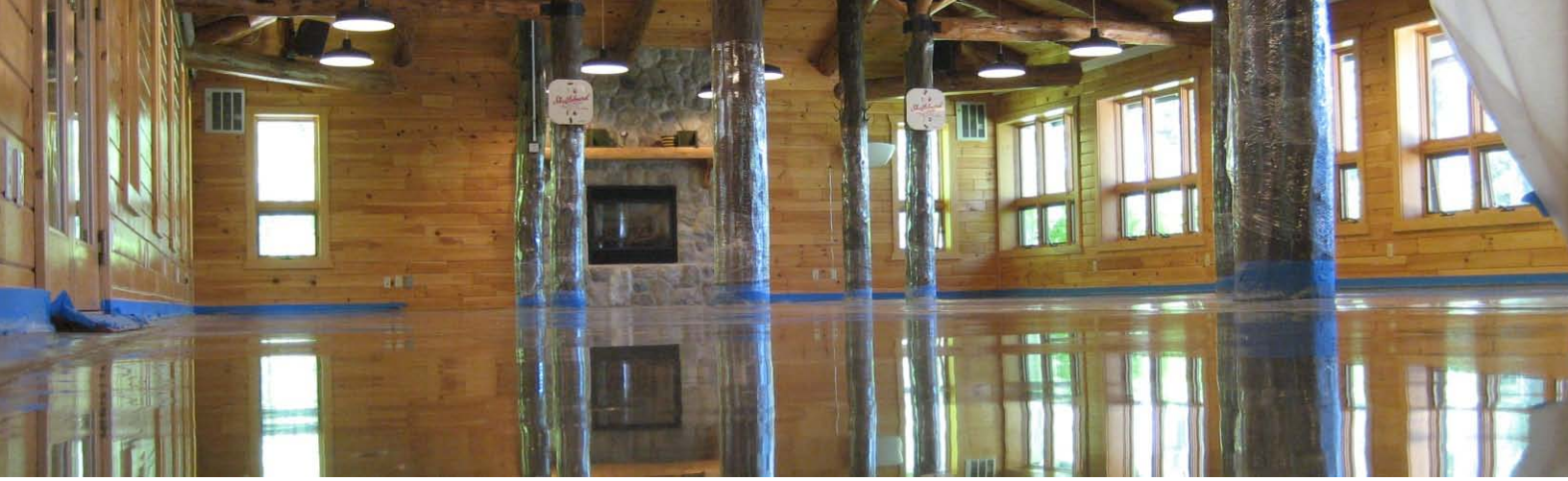

Crystallization vs. Oxalic Acid Polishing

Floor Care Tech Talk — March 2012

Crystallization (also known as re-crystallization or vitrification) is a method of creating a gloss on calcium bearing stone floors such as marble, limestone, and travertine. Crystallization has been in use since the 1960's with varying levels of success and is still a controversial topic among stone care professionals. Many claim successful use with no damage to stone while others claim damage to the stone occurs either immediately or over a period of years. Below is a discussion of what crystallization is and how it differs in process from that of using oxalic acid to chemically polish stone floors.

What is marble:

For our purpose here we will simplify our language and use the term marble to refer to all calcium bearing stones and cementitious terrazzo flooring materials. The chemical content of these stones is primarily calcium carbonate ($CaCO_3$), the same compound that makes up seashells, pearls, eggshells, and common household antacid tablets.

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, aluminum fluorosilicate, zinc fluorosilicate, and water. Some crystallization products may also contain waxes. The chemical reaction illustrated below shows the process taking place during crystallization. Note that magnesium fluorosilicate ($MgSiF_6$) is used in this example but most chemistries will contain a mixture of fluorosilicates. The basic reaction principals are the same no matter which fluorosilicate chemistry is used.

$$MgSiF_6 + 2HCl + CaCO_3 \rightarrow CaSiF_6 + MgCl_2 + CO_2 + H_2O$$

Or

$$3CaCO_3 + MgSiF_6 \rightarrow MgSiCO_3 + 3CaF_2 + CO_2 + H_2O$$

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 ($CaSiF_6$) 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. 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, more glossy, and more stain resistant than the original stone surface. This is the principal behind crystallization.

How does crystallization differ from what is done in the factory or with a polishing compound containing oxalic acid:

Most marble has been polished in the factories using various grades of abrasives followed by a final step using an abrasive in combination with oxalic acid ($H_2C_2O_4$). In an effort to replicate this factory finish

most marble polishes contain an abrasive to remove fine scratches and oxalic acid to replicate the factory process. Unlike crystallization, steel wool is not required when using an oxalic acid polish. Most often, polishes are used with a red or natural floor pad under a 175rpm floor machine. Floors with deeper scratches or other damage, typically must be diamond honed prior to using marble polishing products. During marble polishing, the reaction taking place is shown below.

$$H_2C_2O_4 + 2CaCO_3 \rightarrow CaC_2O_4 + CO_2 + H_2O$$

Again the resulting surface is more glossy than the original stone surface. The difference is that the reaction taking place using oxalic acid does not chemically alter the surface of the stone. The calcium oxalate (CaC_2O_4) formed in the reaction is washed away with the slurry from the process leaving behind a smoothed and polished stone surface that has not been chemically altered.

Note that the above does not mean that oxalic acid will not etch stone surfaces. Oxalic acid (and any acid) dropped on a marble surface will etch. Factory polishing and marble restoration are performed under controlled circumstances to reach desired results.

How does this affect the use of Scotchgard™ Stone Floor Protector on a floor?

Due to the chemical change to the flooring surface crystallized layers must be removed prior to applying Scotchgard™ Stone Floor Protector. Trizact™ Diamond HX Discs are sufficient to remove the crystallized layer and prepare the floor for application.

Floors that have been polished using an oxalic acid product have not been chemically altered and therefore do not need to have a layer removed prior to application. However, for best results it is still recommended that Trizact™ Diamond HX Discs be used to remove all scratching, bumpiness, and other blemishes on the flooring surface.

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Building and Commercial Services Division
St. Paul, MN 55144-1000
1-800-852-9722
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