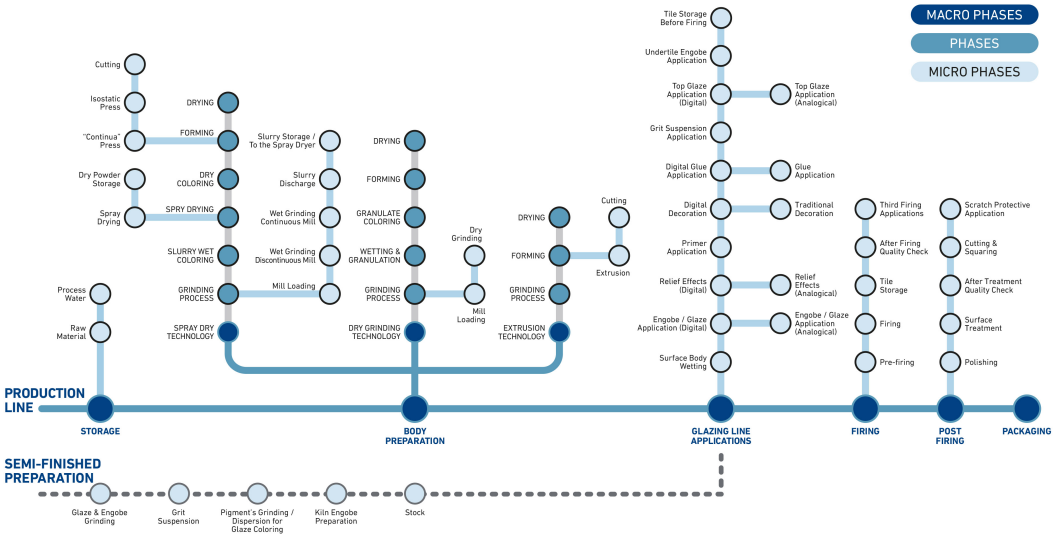
ZSCHIMMER & SCHWARZ
CERAMCO

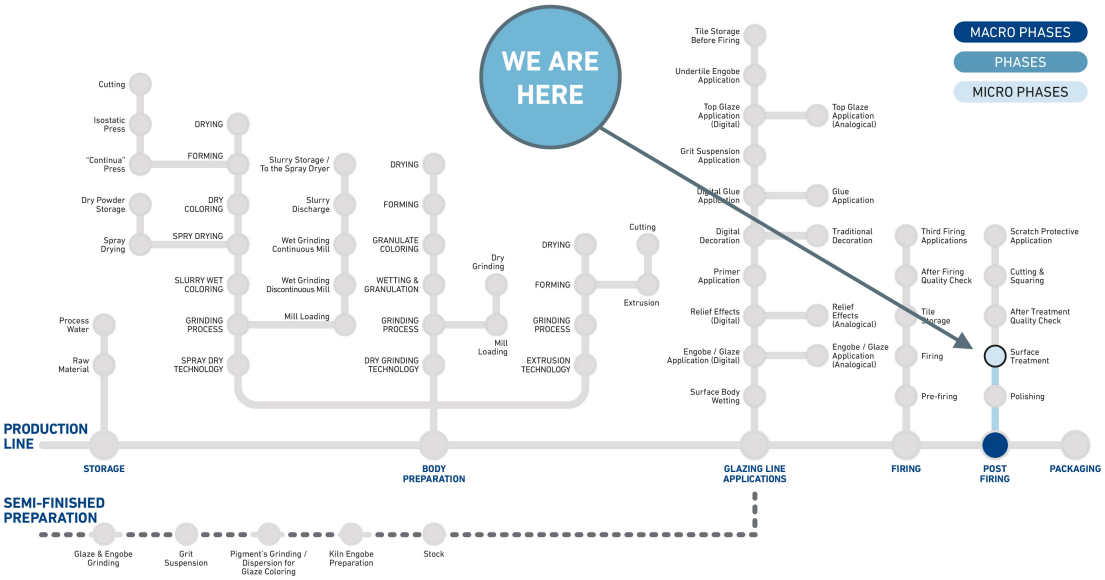
# APPARENTLY INVISIBLE YET CONSTANTLY PRESENT

## At every stage of the ceramic production process

### A journey through problems & solutions




## #05 CRAKS & RECESSIONS INSIDE CERAMIC PORES AFTER POLISHING





Zschimmer & Schwarz
Ceramco S.p.A
Società a Socio Unico
Via dei Falegnami, 7
41049 Sassuolo (MO) | IT

T +39 0536 804 659
F +39 0536 807 168
info-zsce@zschimmer-schwarz.com
ceramco.it
zschimmer-schwarz.com

REG.IMPR. di MO / C.F.
01512870153 –
P.IVA 01600960361

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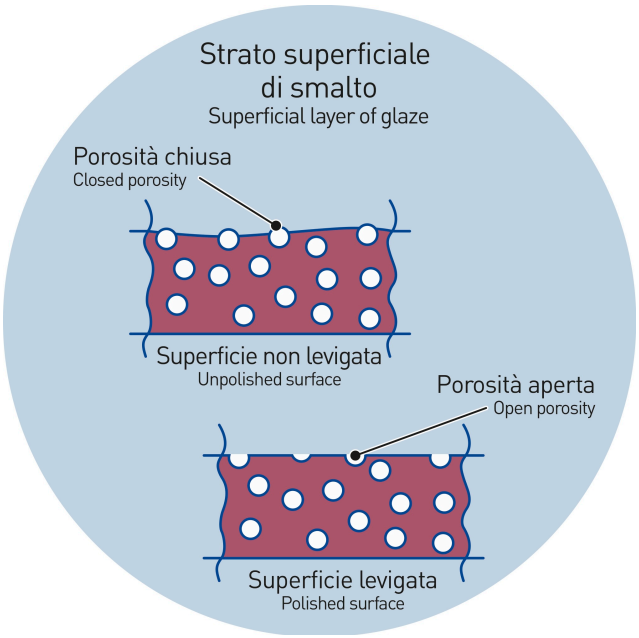
## 1. POROSITY OF POLISHED CERAMIC & DIRT OR CHEMICAL ATTACKS

As we all know, lapping and polishing processes that provide ceramic tiles with the proper aesthetic features, both involve the removal of a very thin layer of glaze that is on the very external part of the tile.

Even if the amount of removed material is almost insignificant, these processes may bring out to the surface all that micro-porosity which are inside the glaze. Since they are no more protected and sealed, the pores remain exposed to the attack of dirty elements: the dirt, one it enters the pores, is nearly impossible to remove.

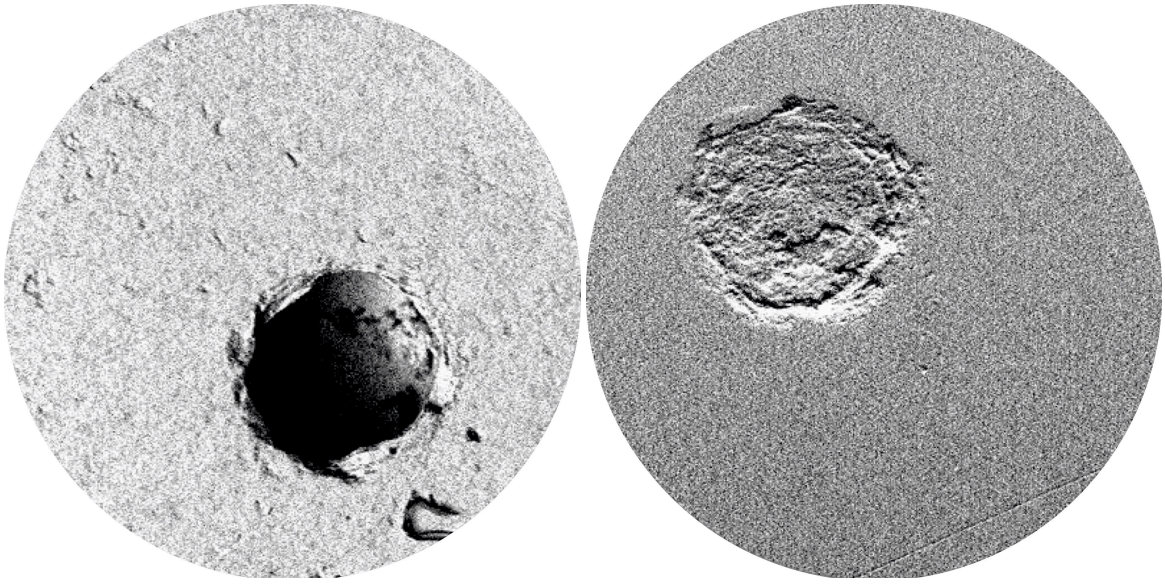
In addition to that, the lapping process brings also out to the surface deep layers of glaze characterized by a less mechanically resistant solid-states.




## 2. PROTECTIVE PRODUCTS

For years now, many sealant products are available on the market capable to restore the original characteristics of the surface and therefore able to reduce or solve the problem.

These are mostly **NANOMETRIC COLLOIDAL SILICA-BASED** products and from a chemical point of view they can be considered as **INORGANIC VITREOUS AND SILICA-BASED POLYMERS**.



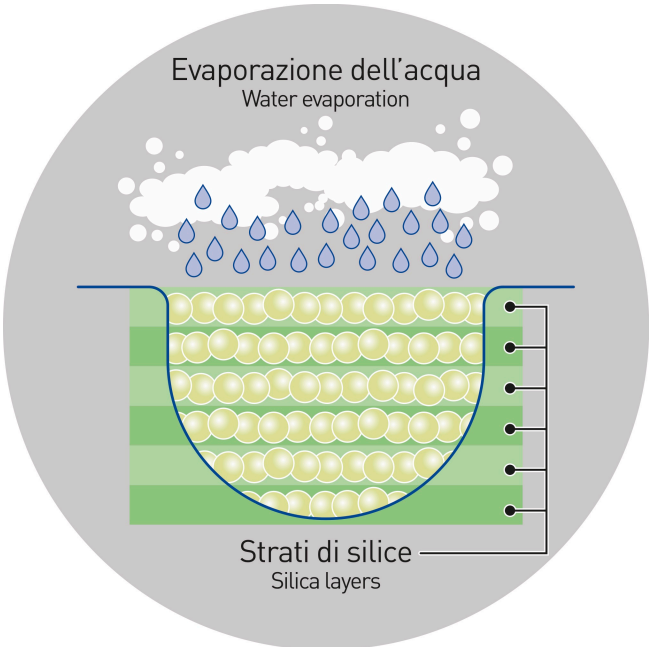
Open pore

Sealed pore

## 3. HOW THE COLLOIDAL SILICA BEHAVE ON THE SURFACE?

Since it has been applied and spread on the tile by means of the proper tools, colloidal silica enter the open pores creating a numbers of multi-layers that fill the holes and pores brought to the surface by the lapping machine.

Along with the distribution and filling processes, the liquid part of the suspension (the water) that contains silica nano-particles gradually evaporates, thus leaving the silica without its solvent.



In other words:

1. The protective product is applied to the ceramic surface
2. The solid part of the suspension fills the pore
3. The liquid part (water) evaporates

At the end of the evaporation process, also promoted by the tools that heat the surface by friction, the result is a **SEAL MADE OF COMPACTED AMORPHOUS SILICA**.

## 4. CRITICAL ISSUES

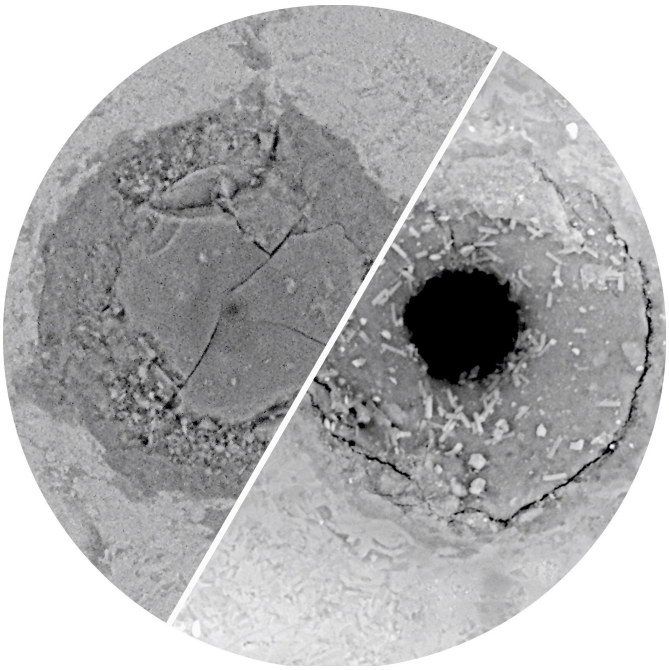
Given the fact that surface protection treatments are very efficient, in some instances, however the surface cannot be declared 100% resistant.

Why?
What happen in simple words?

The seal that is formed inside the pore rapidly and violently loses water, because of to the evaporation process.
This phenomenon produces an effect that is very similar to those that happen on the ground fields during summertime.
Because of the violent and rapid evaporation process:

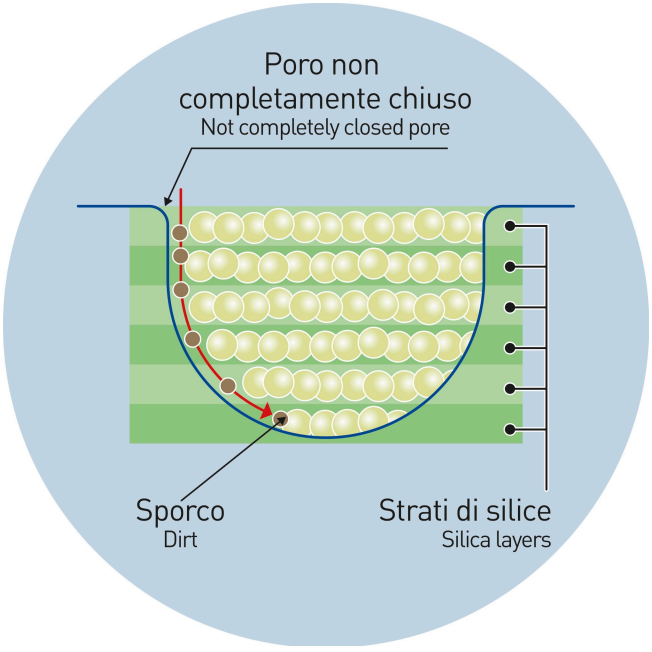
1. The mud dries
2. The hearth recedes
3. Cracks are formed

This is exactly what happens in the pores: the very tiny cracks that are formed partially comprise the protective action of the treatment. In the most extreme cases the silica can collapse.



Withdraw / Collapse

This means that dirty elements as well as particularly aggressive chemical agents can slip between the cracks, reaching the deepest part of the pore. At that point – since the dirt is under the silica seal – it is impossible to remove.



## 5. POSSIBLE ACTIONS

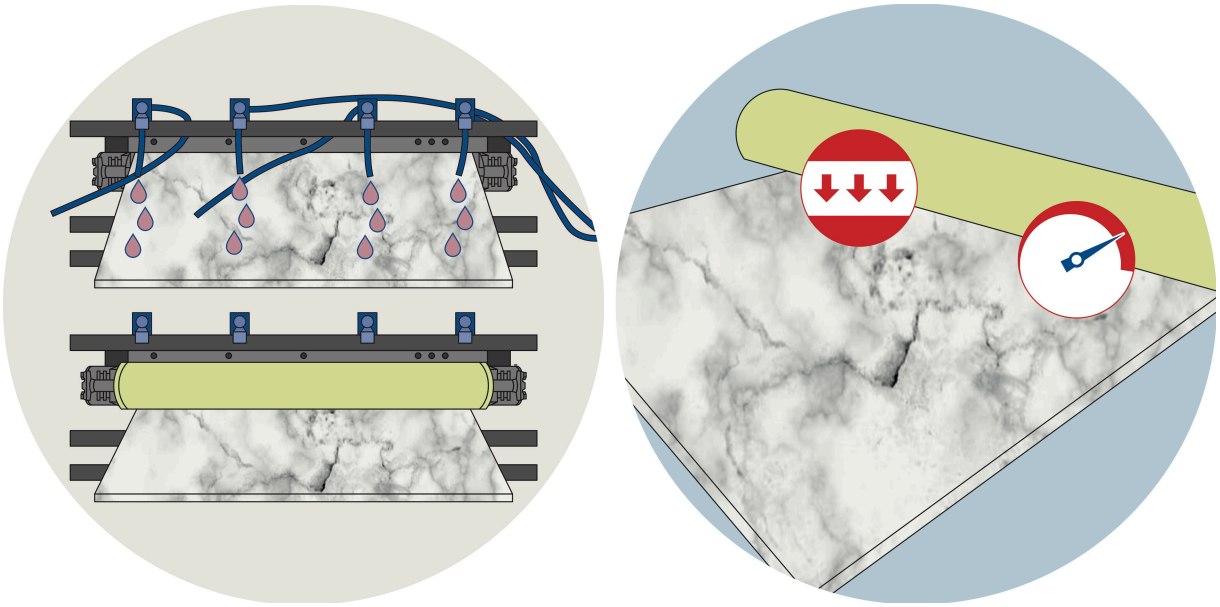
What action can be taken?

### A. APPLICATION MACHINE'S SET-UP

Before working on the product formulation, it is good practice to check the application machine set-up and, if necessary, make all those variations that can lead to a better performance in terms of application.

For example:

- Chose the best application to spread the product inside the pores - such as roller, sponges or drop application systems - according to the kind of material that has to be treated and trying to reach a uniform and constant distribution
- Increase or decrease the pressure and/or the rotation speed of the tools on the tile to vary the product distribution and/or the ceramic material's temperature

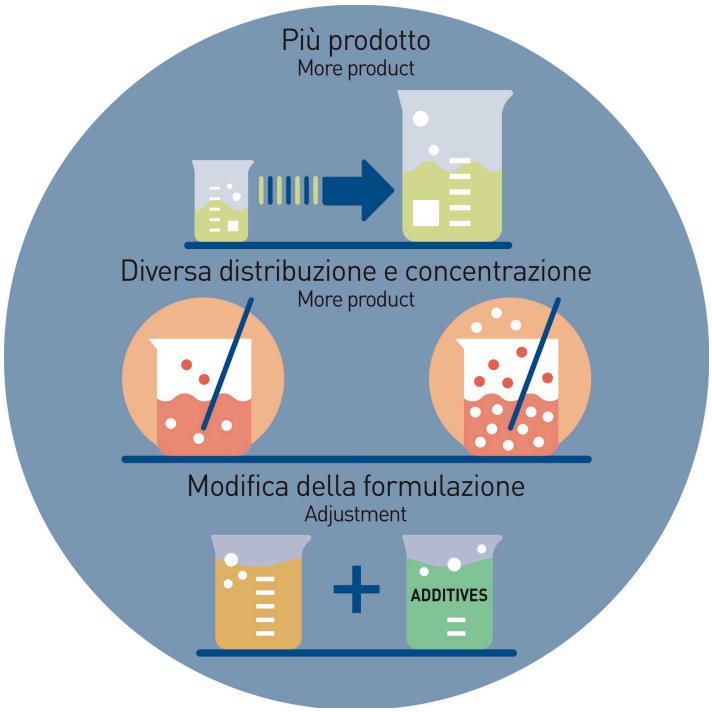


### B. PROTECTIVE PRODUCT

It is also possible to act directly on the protective product, by replacing the type of silica according to the features of the ceramic surface to be treated

What are the most effective interventions?

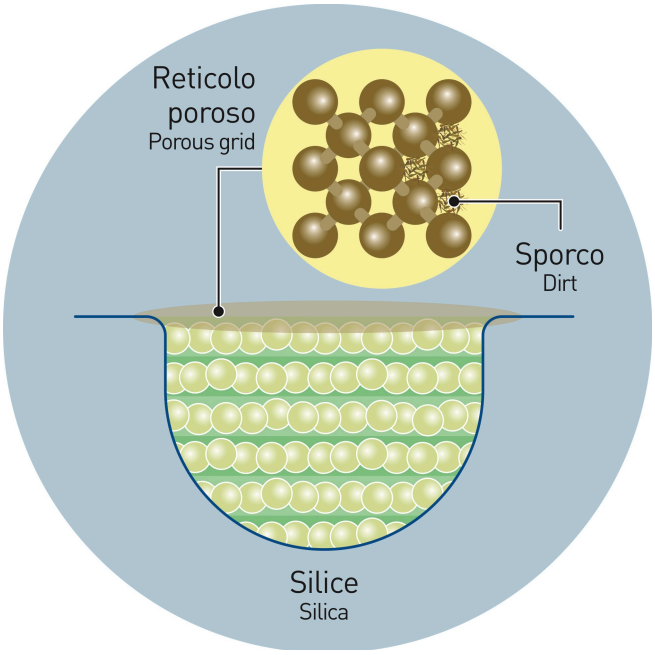
1. Adjust the weight of the applied product: by varying the amount of product it is possible to test and verify the different kind of seals that are formed;
2. Use a colloidal silica with a different concentration or with a different particles distribution inside the suspension;
3. Try to reach, more generally, a different balance between the i*ngredients* of the suspension, by modifying the formulation with proper additives able to control and create a better seal




## 6. THE PERSISTENCE OF THE PROBLEM

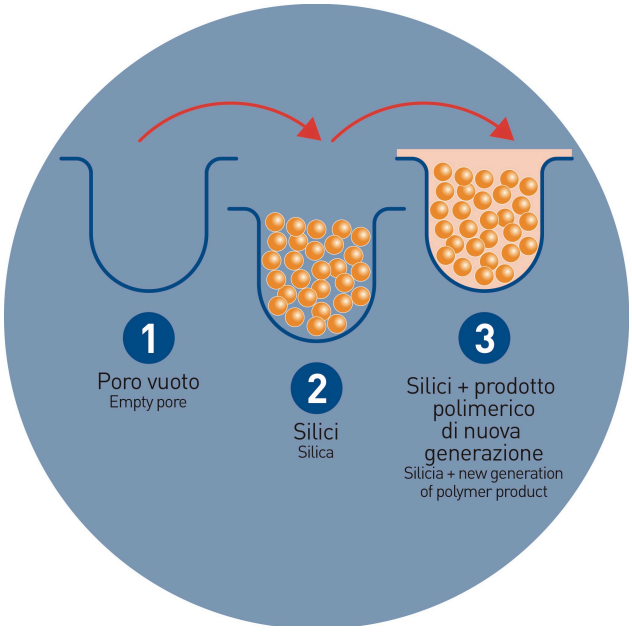
However, despite all these actions, the issue sometimes may persist due to the silica very nature.

In fact, it must be remembered that the amorphous colloidal silica-based seal is marked by a GRID able to absorb some staining and chemical agents:
we are talking about a porous and absorbent system.
Without being drastic or dramatic, it is very difficult (or even impossible) to get a protection product able to cover the 100% of the cases.




## 7. WHAT'S GOING ON

If this is the scenario, it is so comforting to know that a new generation of polymeric products is currently under examination (and in some cases already available).
These products act at the molecular level, since they are able to be absorbed and chemically bind to the silica grid that has previously sealed the pore. Once they have been applied, they integrate with the system leading to a definitive sealing of the cracks.



IN SUMMARY

Colloidal silica offers on one side several benefits such as:

- No change in color of the ceramic material under UV action
- Resistance to acid
- Durability

On the other hand, they tend to create inhomogeneous and amorphous grids marked by mechanical tension that can lead to the formation of cracks and collapses.

The new generation of polymeric products, instead, chemically react creating a real and mostly impenetrable film.

More to come.

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