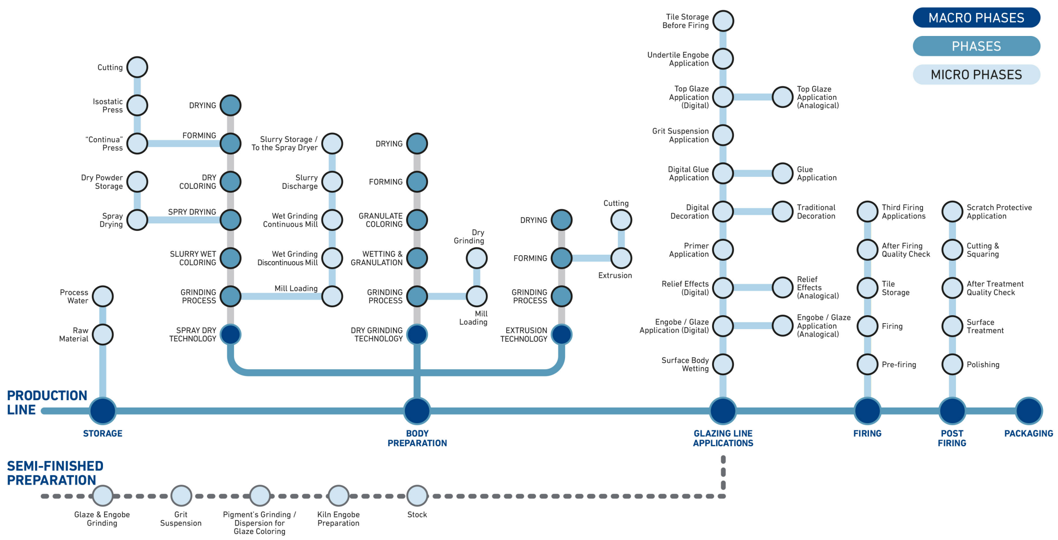
ZSCHIMMER & SCHWARZ
CERAMCO

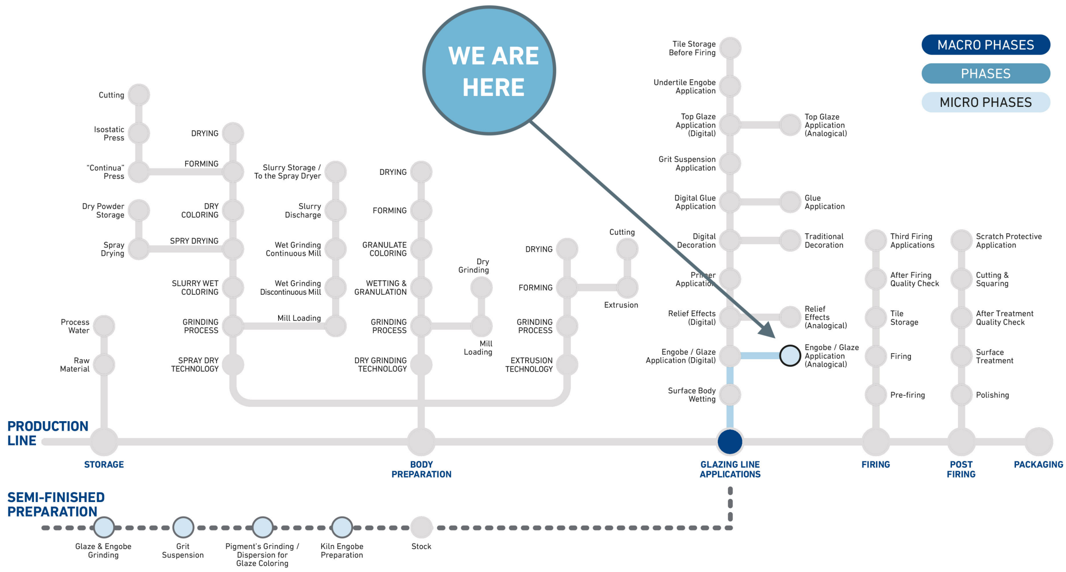
APPARENTLY INVISIBLE YET CONSTANTLY PRESENT

At every stage of the ceramic production process

A journey through problems & solutions



#10 DIGITAL GLAZING BY MEANS OF NON-PIEZOELECTRIC SYSTEMS



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

CAPITALE SOCIALE -
€ 3.100.000,00 i.v. REA di Modena
199597 Mecc. MO 009298 –
NR. PART. EU. IT 01600960361

Contents

1. GLAZES & APPLICATIONS TECHNOLOGIES

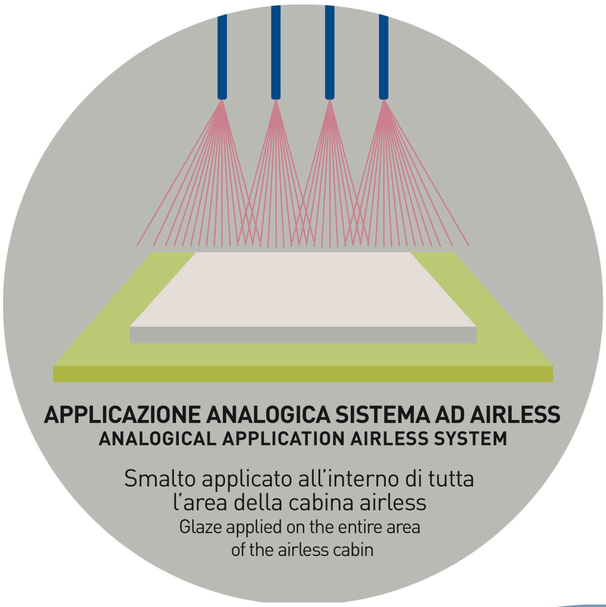
The ceramic glaze application – both before and after the digital printing process – takes usually place by means of "analogical" systems: by spray / airless application systems.
Nevertheless, some new application machines have been recently appeared on the market. They cannot be defined as completely digital, but they cannot even be comparable to traditional analogue techniques.

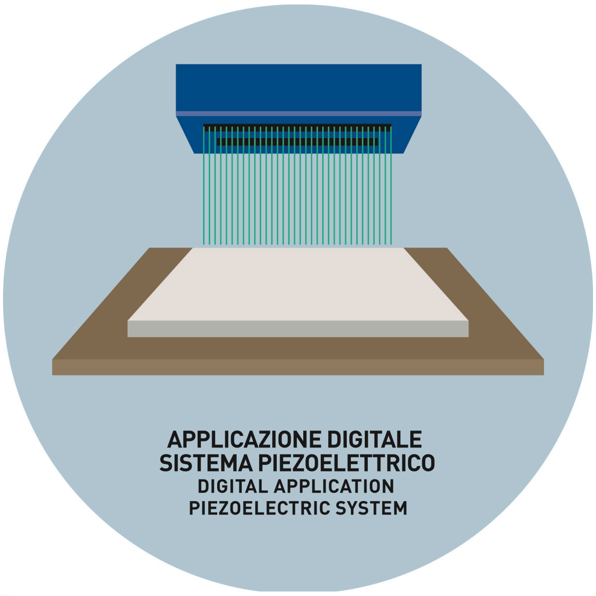
In some way we could talk about digital glazing by means of non-piezoelectric systems, even if the use of the word DIGITAL is probably incorrect.

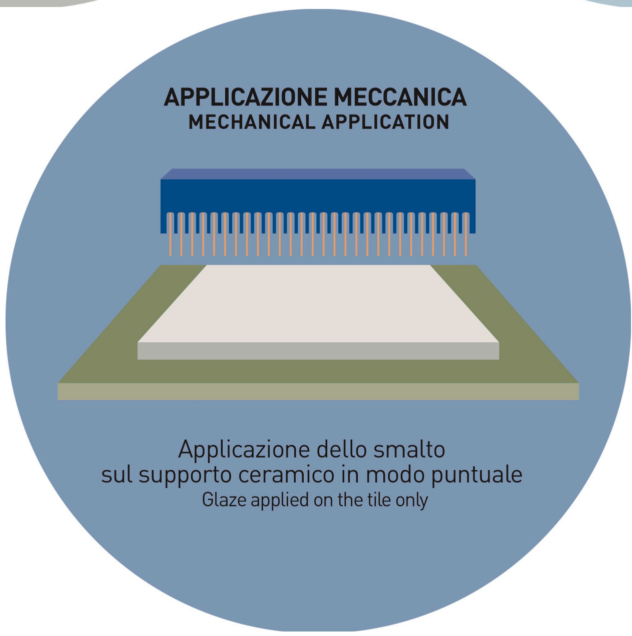
What does that mean?

Without entering in a very complex field and without categorizing, these new application machines are based on a different kind of injection and deposition of the glaze on the raw ceramic surface: the technology they provide is not totally digital but at the same time it cannot even be defined as analogical.

When we talk about digitalization, in this specific case, we are therefore not referring to the application technology itself but rather to the greater control and to the improved automation that these machines are able to provide.





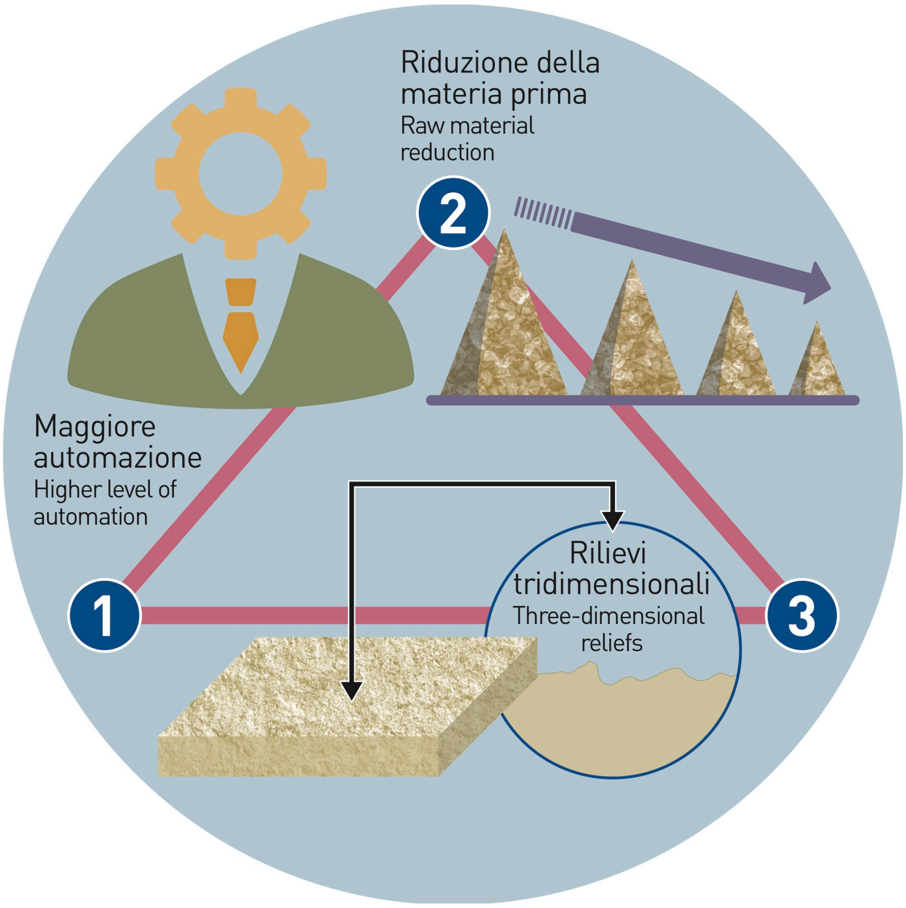


These machines, even if they are still under implementation and under evaluation by ceramic tiles producers, they have been developed to reach - in the future - some important goals:

The first is about the possibility to decrease the supervision of the operator thanks to the greater automaton of the machine.

The second is about the possibility to reduce the amount of glaze thanks to its pinpoint application that do not need traditional suction systems as well as the frequent and repeated washing of the spray cabin required by the airless application systems.

And finally, the third goal is the glaze application with tridimensional relieves.
This third option will be probably not immediate but soon the new technology may support the creation of textures currently made by means of the presses at the beginning of the ceramic production process.

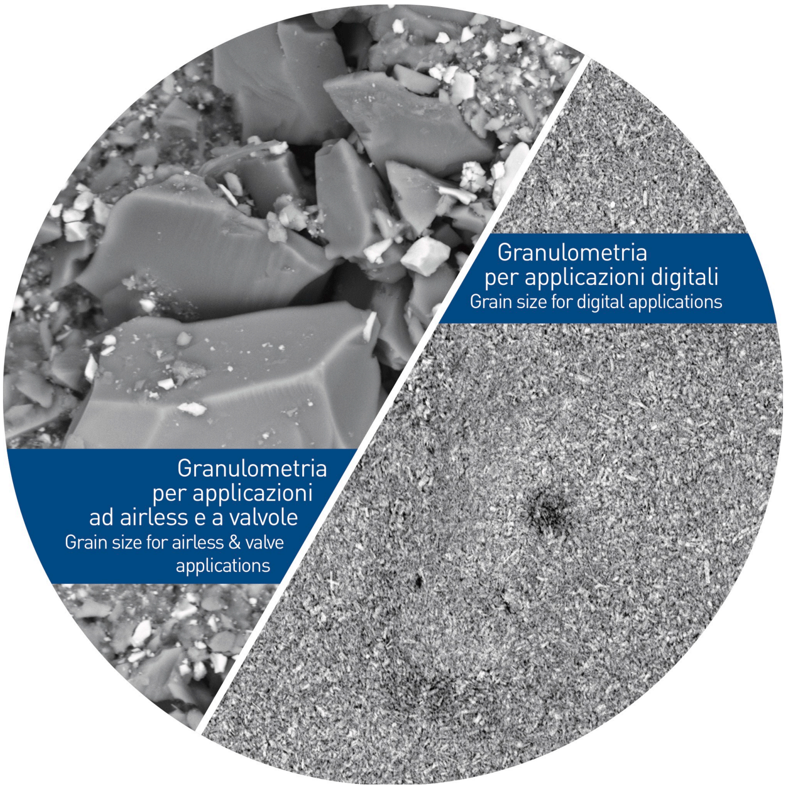


2. A COMMON DENOMINATOR: THE GLAZE'S PARTICLES SIZE

At present, there are on the market several non-piezoelectric machines such as those we are talking about. Each of them is marked by its own features but, however, they all have a common denominator.

They can work with same kind of glazes that are used with airless applications: with glazes that have the same particle size. Very similar, if not identical.

This is very important, because it allows ceramic producers to be very flexible in terms of purchasing and logistic, since they do not need to buy specific glazes to be only used with these machines.



From a chemical point of view, this also means that each producer can work - or act - on the rheology of the glazes already in use, providing them with the proper parameters according to the different machine set-up.

We are implying that **the glazes' rheology must be carefully studied** to reach a good performance during the process.

And regardless the specific features of each machine, they all can work in two different directions:

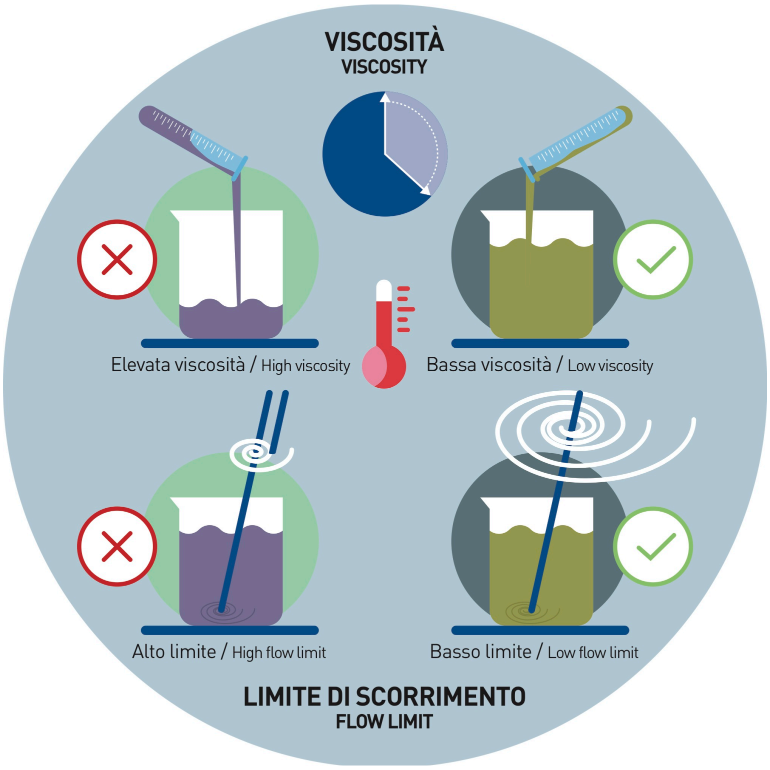
a) full field applications
b) relief applications.

3. FULL FIELD APPLICATIONS

In this first case **it is very important to reach a uniform leveling of the glaze on the ceramic support**

VISCOSITY & FLOW LIMIT

To make this happen, the glaze should have **a low viscosity value** (slightly higher than a glaze usually used for spray applications) and at the same time it should be marked by a **not too high flow limit**.



Reminder: the flow limit is the VALUE of the MINIMUM EFFORT required to run a fluid.

The low viscosity together with a not very high flow limit allow you to reduce (or even avoid) possible **sedimentation phenomena or separation** between the liquid and solid phases of the system, that in turn may lead to **localized sedimentation problems** within the unit circuits of the application machine.

SUPERFICIAL TENSION

At the same time, it is important to carefully check the **surface tension of the glaze** to reach a good **homogeneity** without compromising the **cohesion**.
This is very important to provide the glaze with a **"compact effect" after application**: a compactness both in the middle and at the edges of the tile.

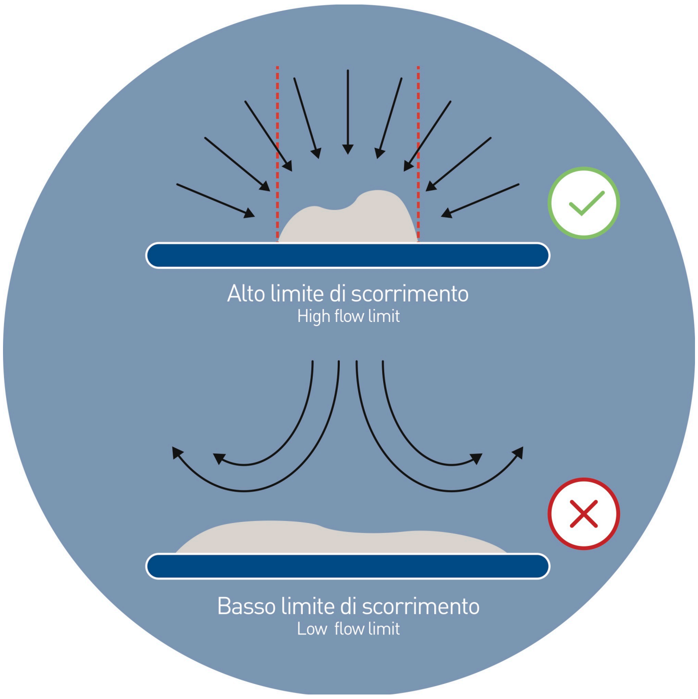
Of course, these are general indications because, as we know, all rheology values (and so the features of the glaze) must be regulated according to the machine and the kind of application.

This means, for example, that if we replace a glaze during a process (or even we change its density value), we should proceed with a new rheological study to restore the balance (that is very delicate) between all parameters.

4. RELIEF APPLICATIONS

A) FLOW LIMIT

To get high level of printing resolution, in this different scenario, the drop of the glaze must remain in its place, where it has been discharged, without collapsing and without expanding on the ceramic support.
To make this happen, the glaze should be marked by a **high flow limit** and it should be able - at the same time - to rapidly restore its structure after its deposition on the raw ceramic surface.



B) THIXOTROPY

Thixotropy: property of pseudo-plastic fluids to change their viscosity over time when subjected to a shear stress (moving for example from a pasty state (we could say almost solid) to a fluid state).

What kind of thixotropic features the glaze should have?

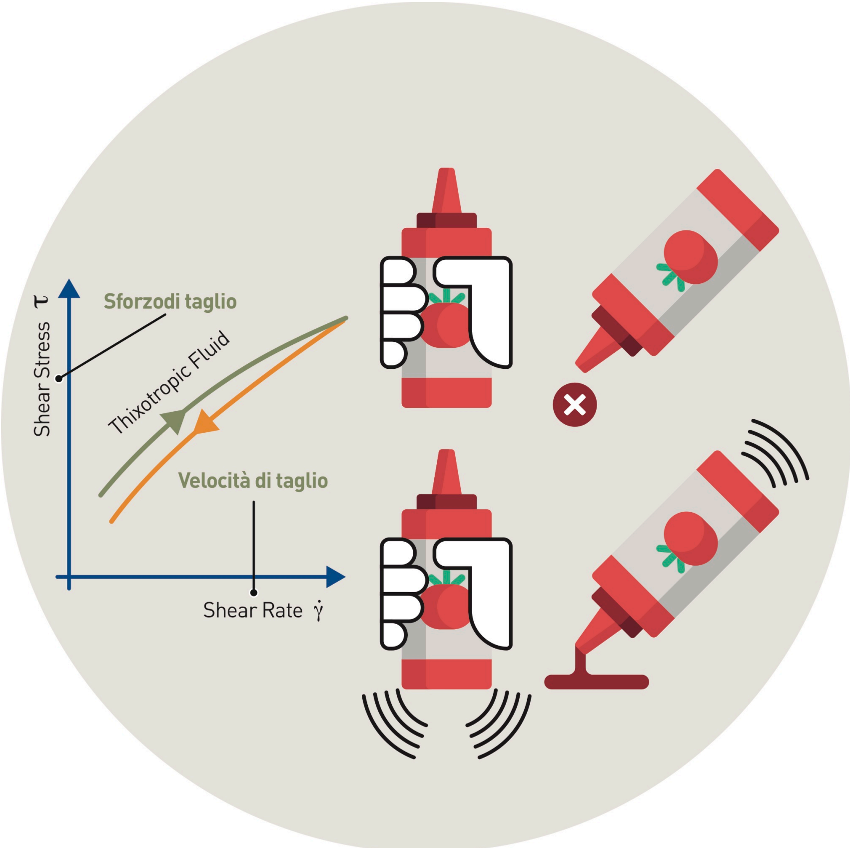
The thixotropic effect should not be very high, so that the fluid can keep its original features of **viscosity and cohesion,** preventing the drops to collapse on the ceramic body and therefore without compromising the definition of the application.

THIXOTROPY OF A FLUID: LA *CUISINE* AS AN EXAMPLE

To better and more easily explain what thixotropy is (that by chance is a very common feature of a great number of fluids) let's take an example from the cooking world.

In this area, ketchup is the most popular example of a thixotropic fluid.
The ketchup, when resting in the bottle it appears as compact, thick, and almost solid but when shaken, instead, it loses or even better it changes its structure, becoming more fluid, able to easily get out of the bottle.

The topic of course is very complex, and it would deserve deeper explanations but this example even if it's very simple is at the same time very effective.



C) VISCOSITY & COHESION

Given that the glaze should not be marked by a high thixotropic behavior, **the system's viscosity value**, unlike full field applications, **shouldn't be too much low** so that the drops of the glaze (that of course undergo to the stress of the application machine) do not lose their viscosity and therefore do not collapse on the ceramic body surface. The glaze must not lose cohesion and so the glaze drops must be bond one with the other.

What does that mean?

Suppose you through on a desk simultaneously and violently a little mayonnaise and honey.
Mayonnaise, since it's not very viscous, will lose its cohesive force, splitting into several parts and leading to separate drops all over the surface.

Honey, instead, thanks to its high viscosity, will be more compact, remaining still, exactly where it has been thrown (even if – of course - it slowly spreads over time because of its low flow limit value).

In short, all this to say that our glaze should be more like the honey, and so more viscous, to keep its compactness once it has been discharged by the nozzles of the application machine.