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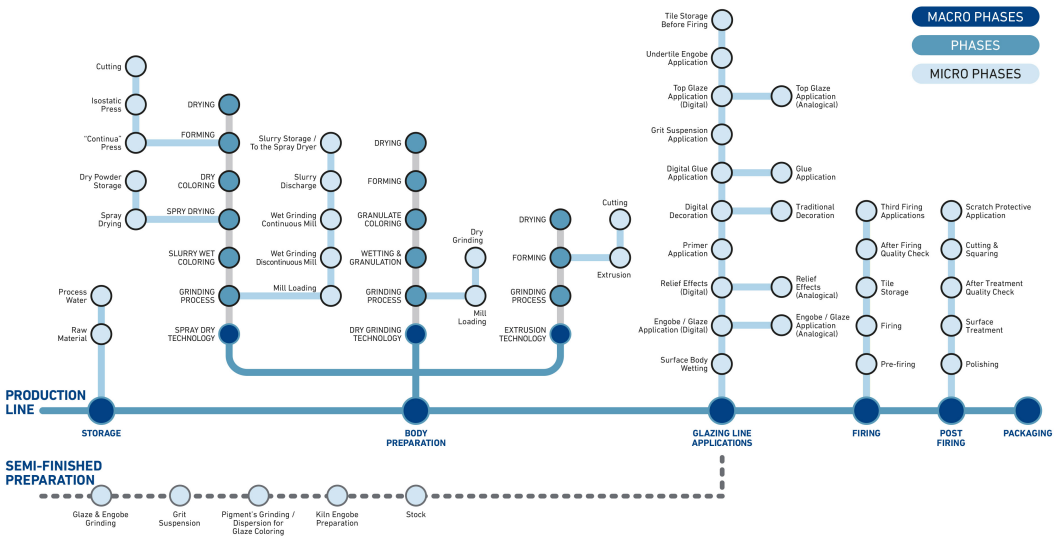
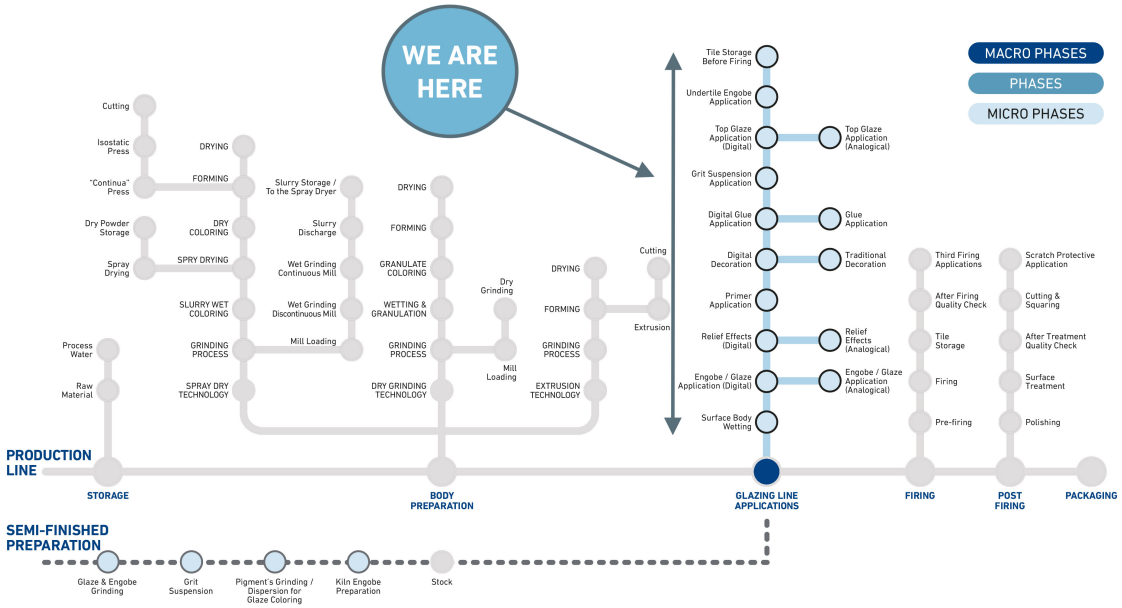
APPARENTLY INVISIBLE YET CONSTANTLY PRESENT

At every stage of the ceramic production process

A journey through problems & solutions



#62 CRATERING PHENOMENA & CERAMIC GLAZES: IN SHORT



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Contents

01. Raw materials impurities..... 02
02. Incorrect use of defoaming agents.....02
03. Incorrect application parameters..... 03
04. Contamination of the suspension..... 04

Cratering — like many other defects that can appear in ceramic bodies — rarely stems from a single cause. It's usually the result of several contributing factors that interact with one another. While the list of potential causes is quite extensive, we can narrow it down to four of the most common and impactful ones.

a) Raw materials impurities
b) Incorrect use of defoaming agents
c) Incorrect application parameters
d) Contamination of the suspension

A) Raw materials impurities

Glaze suspensions contain not only frits but also raw materials such as clays and feldspars. Because these are natural materials, they can include organic impurities, primarily carbon-based residues. Clays are often the main source of this type of contamination.
During milling, carbonaceous residues do not wet properly and remain incompatible with the aqueous phase of the suspension. When the glaze is applied, this incompatibility causes breaks in the glaze film — preventing uniform coverage of the surface and leading to the formation of the characteristic micro-crater, known as a cratering defect.

How to address the issue
Adding a suitable surfactant can help bridge the gap between impurities and the suspension system. These molecules — composed of a hydrophilic head and a hydrophobic tail — surround the incompatible particles, stabilizing them within the liquid phase. This prevents glaze film breakage without the need to adjust process parameters on the production line.

However, not all surfactants behave the same way. Some are formulated for high-density systems (such as bell application), but they may perform poorly in lighter systems like airless applications. For this reason, surfactant selection must always be carefully matched to the rheology, application method, and working density of the glaze system.

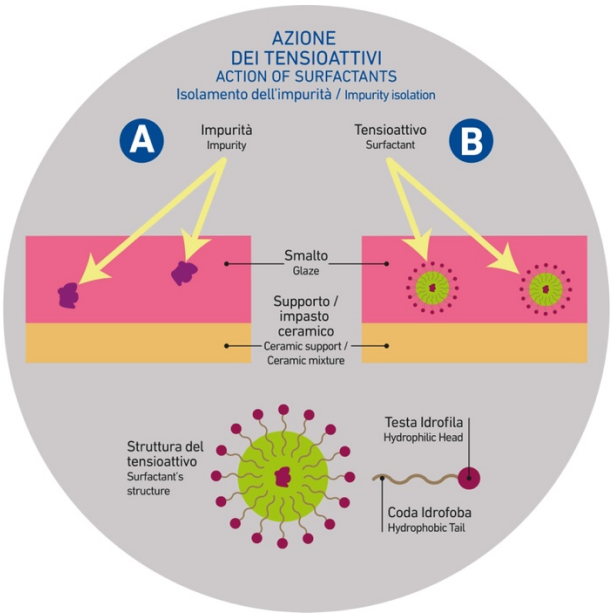
B) Incorrect use of defoaming agents

Defoamers are designed to eliminate air bubbles that may form within the suspension. They work because they are mostly partially insoluble in water, which allows them to disrupt the thin liquid film surrounding the bubble and make it collapse.

Problems arise, however, when defoamers are used incorrectly. In glazes with low clay content or in high-hardness formulations (such as those composed mainly of frit), the defoamer may remain poorly dispersed in the suspension.
This can lead to surface defects such as cratering or pinholes.

Corrective actions:

- Select a defoamer type that is fully compatible with the system and with any surfactant already present.
- Adjust the dosage according to the rheological characteristics of the suspension.
- Consider modifying the surfactant, keeping in mind that defoamers and surfactants always act in combination and must be balanced accordingly.



C) Incorrect application parameters

Among the various process parameters, two have a particularly direct influence:

- Excessively long drying times
- Low density or viscosity

If the suspension remains fluid for too long, impurities or residual defoamer traces have more time to act, increasing the likelihood of surface defects such as cratering.

Possible corrective actions

- Increase the suspension density by reducing the water content in the formulation — for example, by using high-efficiency dispersants or binding additives that do not excessively raise viscosity.

- In extreme cases, reconsider or reformulate the fluidization recipe.
- Adjust directly on the production line, such as repositioning the applicator in warmer areas to promote faster evaporation.

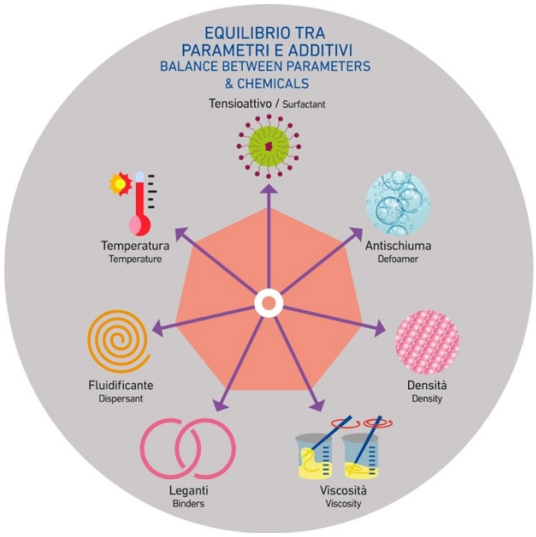
Ultimately, there's no single ideal setting. The goal is to find the right balance between the line conditions and the production targets.

D) Contamination of the suspension

Another common source of cratering is contamination within the glazing line, often occurring when production shifts from one glaze to another without proper cleaning of the equipment — such as the airless cabin, curtain coater, bell applicator, pipes, or tanks.
Additive residues, especially defoamers, tend to cling to these surfaces. Once the next batch runs through, they can react with the new suspension and cause incompatibility issues that eventually lead to cratering.

Prevention:

- Thorough cleaning of equipment using specific cleaners designed to remove oily residues.
- Limiting the use of aggressive or highly specific defoamers, to reduce compatibility issues when switching between different glaze formulations.



In Summary: Cratering never comes down to a single cause — it's usually the outcome of several factors working together. The best way to keep it under control is through a smart balance of choices: using the right additives and surfactants, keeping process settings well-tuned, and paying close attention to equipment cleaning and maintenance.