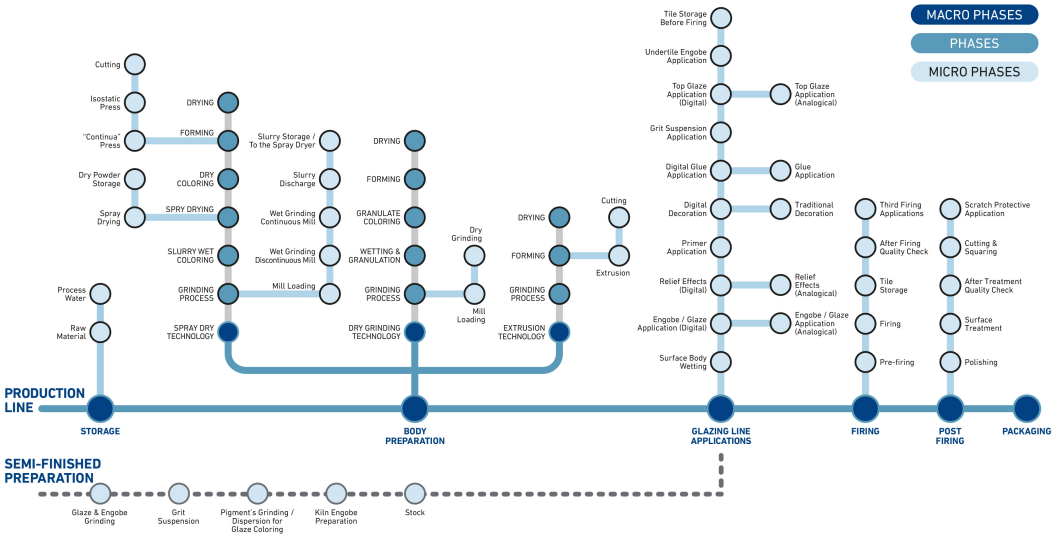
ZSCHIMMER & SCHWARZ
CERAMCO

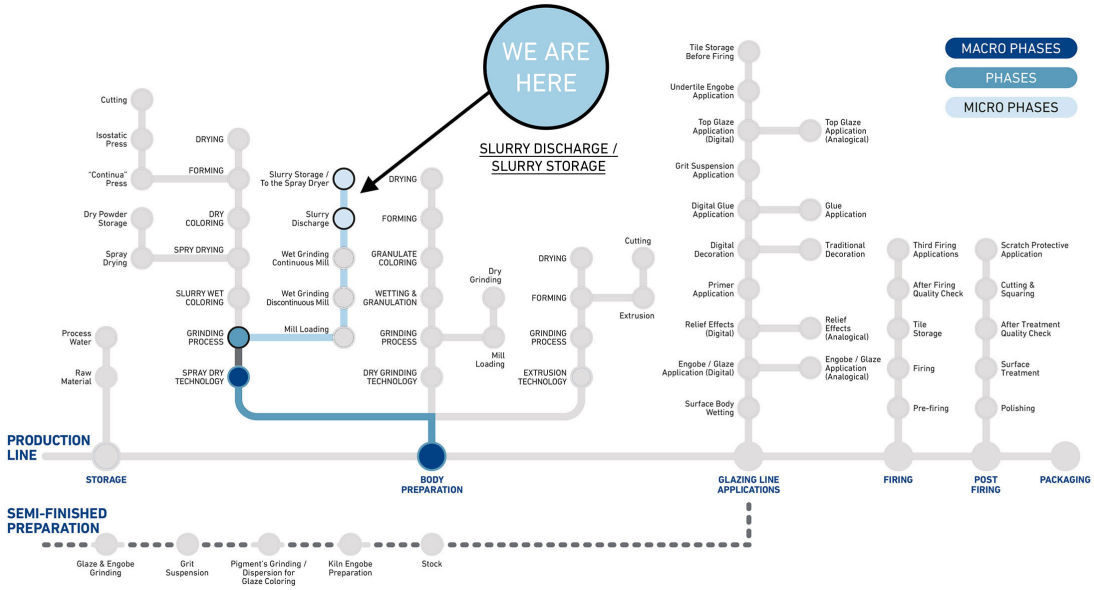
APPARENTLY INVISIBLE YET CONSTANTLY PRESENT

At every stage of the ceramic production process

A journey through problems & solutions



#02 WHY DO SLURRIES JELLIFY DURING STORAGE?



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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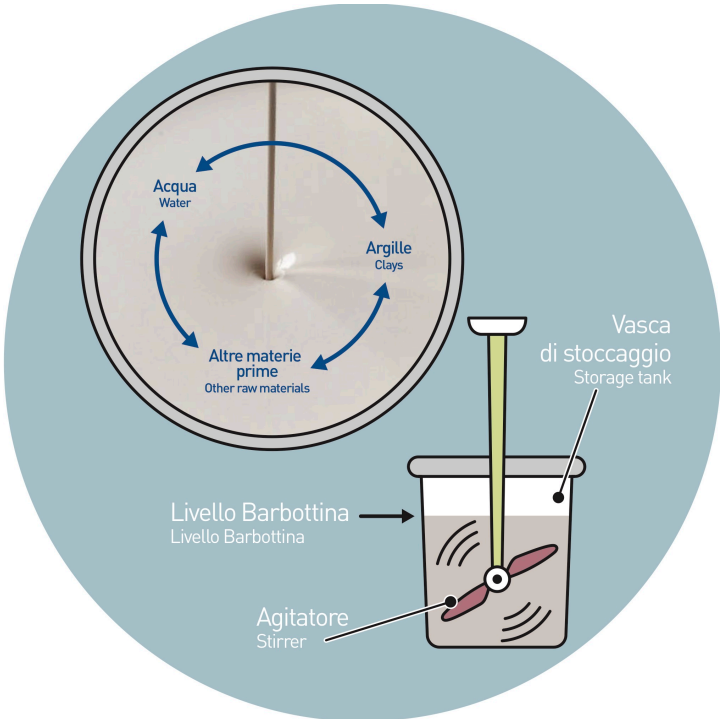
1. WHERE ARE WE?

The slurries gelling phenomena that can occur inside the storage tanks are not so uncommon at one might suppose. We could fix it on the production process's map as follow:

→ MACRO PHASE: CERAMIC BODY PREPARATION
→ PHASE: GRINDING PROCESS
→ MICRO PHASE: SLURRY'S DISCHARGE AND STOKING

2. PARAMETERS TO BE CHECKED

As many know, the slurries (the mix or SUSPENSION of water, clays and raw materials that form the basic ceramic mixture) before being processed within the atomizers, can rest for shorter or longer time inside the storage tanks, where it undergoes to a slow and constant stirring action to avoid excessive and localized viscosity phenomena.

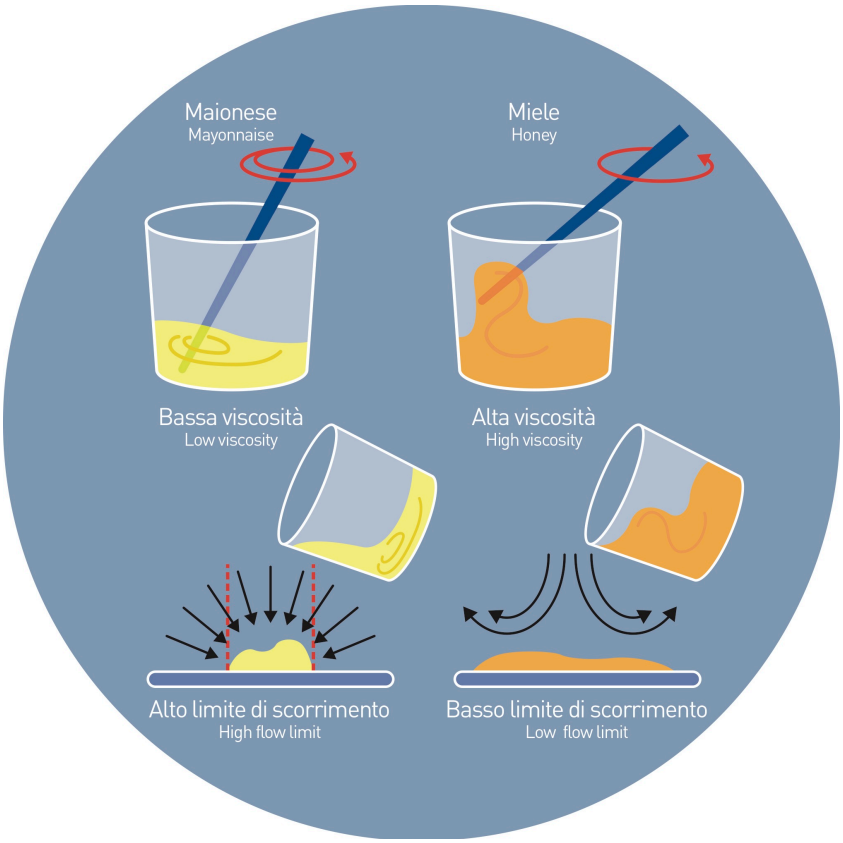


The slurry inside the tanks must be characterized by proper parameters of **viscosity** and **flow limit** to be correctly applied in the following phases of the process.

What do these parameters indicate?

We can basically say that the viscosity's parameters identify the **RESISTANCE** that a fluid opposes to its flow while the flow limit is the **VALUE** of the **MINIMUM EFFORT** required to run a fluid.

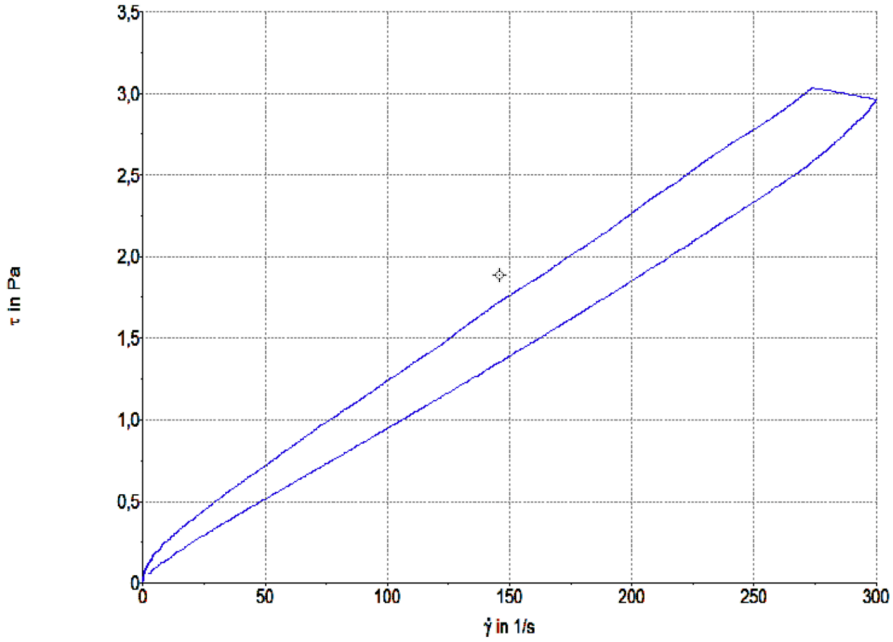
To better understand, we can give an example from the world of cooking where chemistry plays an important and surprising role.



THE HONEY
The honey, for example, is a **viscous fluid** characterized by a **very low flow limit**.
If we spill it on a table we could notice that it expands more or less rapidly on the surface. This behavior is mostly due to the fact that it does not need an important effort to run.

THE MAYONNAISE
The mayonnaise, on the contrary, is a **low-viscous fluid with a high flow limit**.
If we pour it on the same table, we will see that it remains exactly where it has been spilled because of its high flow limit. At the same time, since it has a low-viscosity value, the mayonnaise does not require an important effort to run (if, for example, we put it in a blender or a mixer).
Things would be different if we did the same with the honey: being more viscous, it needs a greater effort, putting under a higher pressure the household appliance.

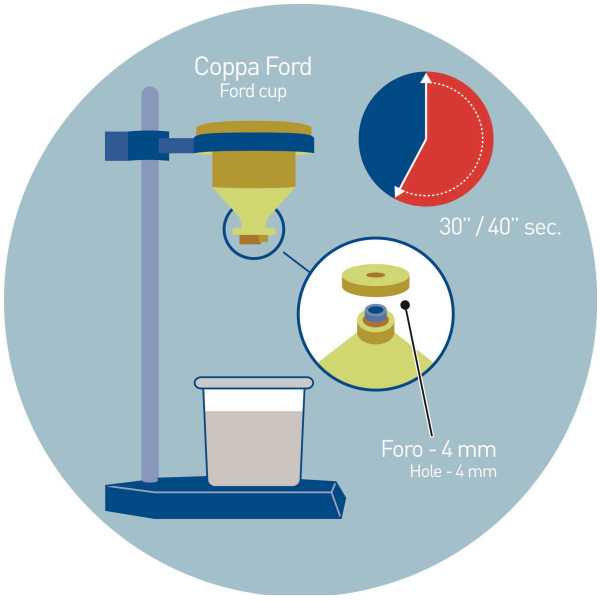
Coming back to ceramic, viscosity and flow limit values are usually graphically displayed by means of Cartesian charts that clearly show the slurry behavior.
The graphic presents on the vertical axis the **shear stress** (the value of the force applied to the fluid to run) and on the horizontal axis the **shear rate** (which is a physical size related to the speed of the fluid).



In general, slurry's viscosity parameters are correct when the data resulting from the **CUP FORD 04's** range between 30" and 40" seconds.

What does that mean?

It means that the time that the slurry takes to pass throughout the hole of the Cup (whose diameter is in most cases of 4mm) should be within that time frame.
If it takes more time, the slurry could be too viscous. If instead times are quicker than requested, the slurry could be too watery, easily leading to sedimentation phenomena and problems during the grinding phase.



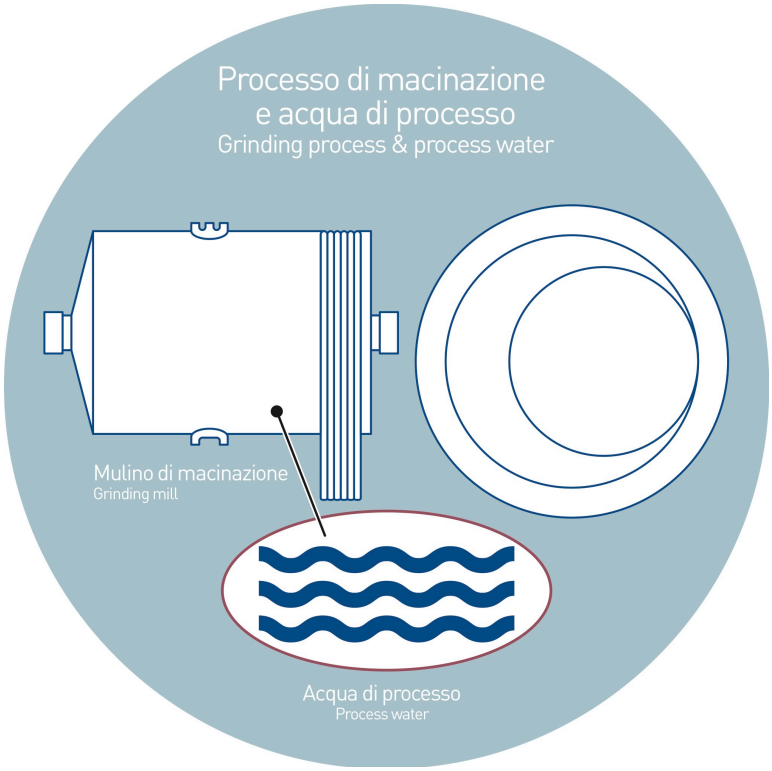
A too viscous slurry can lead to two different kinds of problems:

1. Longer sifting times after the milling process (sifters are for keeping and retaining the slurry's coarser parts, that could affect the following phases of the process, especially the atomization's one)
2. Higher effort of the stirring system

Vice versa, if the flow limit is too high, some jelly phenomena may occur during storage.

3. ROOTS OF THE PROBLEM

The slurry's gelling phenomena that take place in the storage tanks, usually have their origin in the previous grinding phase.
If we exclude errors in the formulation or problem with the production equipment, the problem is usually due to a change of the process water's characteristics or, more rarely, to some inorganic raw materials that present highly non-standard quality features.



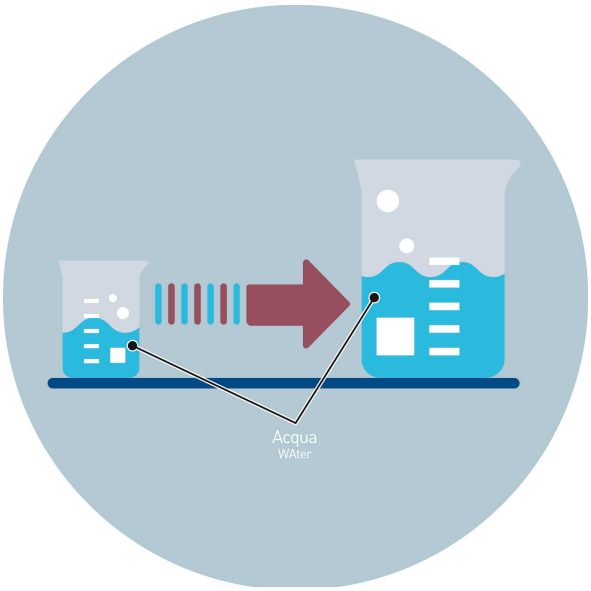
4. ACTIONS & SOLUTIONS

A.

First of all, it is important add to the slurry a proper FLUIDIFYING AGENT so to restore the flow limit and/or reduce the viscosity, providing the slurry with a higher fluidity.

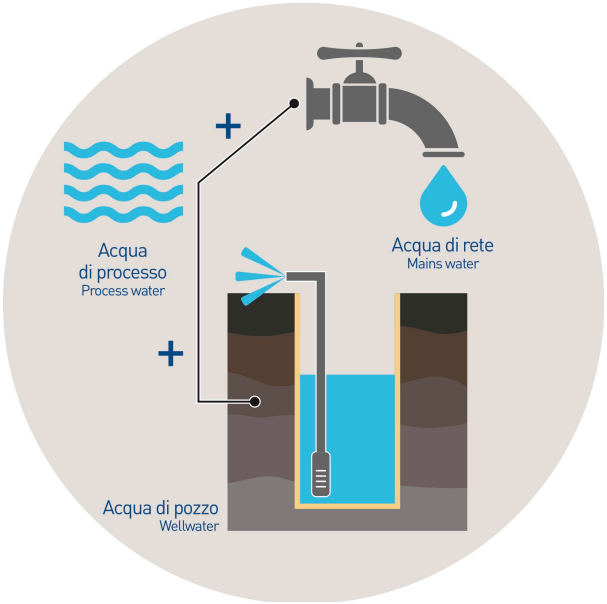
B.

It is also possible to increase the amount of process water of the grinding phase to reduce the viscosity and the flow limit values, therefore facilitating the sieving process.



C.

If the problem is due to the nature and/or the features of the process waters, a careful analysis of the values is recommended. In these cases - to reach the requested standard parameters - it is sometimes possible to add mains and well waters to the process waters



In the extreme case the producer must make a drastic change in the process water, it is necessary to proceed with a new fluidisation study within the lab, revising ALL parameters.

FOCUS
SLURRY AS A SUSPENSION

A **suspension** is a heterogeneous mixture containing finely divided solid particles whose dimension prevents too short sedimentation times.
They are formed by a minor part dispersed in a majority part of liquid. Unlike **solutions**, within which the two elements form a perfectly transparent liquid, suspensions are opaque and turbid mixture.