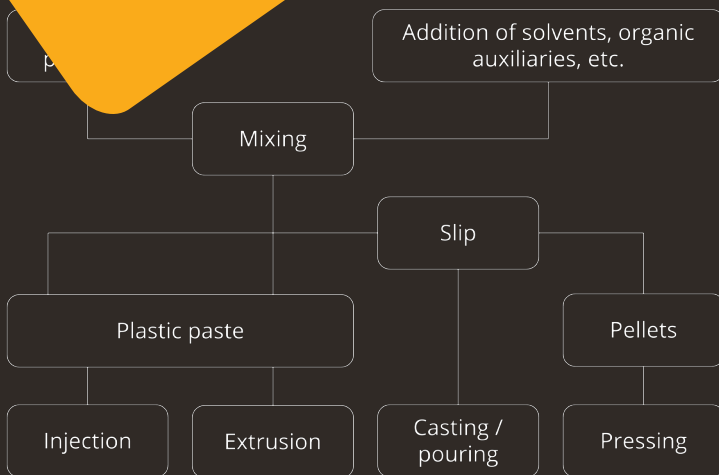


Technical ceramics

Shaping processes

Because of their properties (high melting point, high hardness, lack of ductility at low temperature, low toughness), ceramic objects are usually formed by consolidation at high temperature. The starting material structure (part raw or pre-fired) is often a key factor in the shaping process.

The most common shaping processes are slip casting, injection, extrusion, pressing, etc. The use of solvents, organic auxiliaries, plasma spraying, etc. is common. The use of liquids and auxiliaries is common (drying, debinding) before sintering.



The shaping of traditional ceramics can be done using a suspension (wet process), plastic paste (semi-wet process) or granules (dry process). These are essentially criteria of size and shape of the parts and production cost that govern the choice between these three paths.

FROM A SUSPENSION

The aqueous suspensions of mineral raw materials used in the preparation of ceramics are called suspensions. They contain a significant fraction of large grains (10 to 100 μm) in particular in the porous bodies (bricks, tiles, etc.) in processes, for the shaping of hollow bodies (pipes, tubes, etc. or pieces or dishes) and for the casting of ceramic parts.

In all cases, the suspension is poured into a mold before the extrusion. The drying process occurs most often after the casting. The drying process is the removal of water from the material, called cake or cake. The drying process is usually a drying step.

In the case of casting, the water is transferred into the porosity of the mold. If the pores of the mold are significantly smaller than the size of the cake, the transfer occurs without external stress under the effect of capillary suction. The use of a degreaser made up of large grains ($> 40 \mu\text{m}$), which stabilize large pores within the cake, can therefore be very favorable. In practice, the pore size is centered on 1 μm for plaster molds and on 15 μm for resin molds (need to apply pressure in the latter case).

FROM PLASTIC PASTE

Plastic pastes behave like non-Newtonian fluids with a high threshold stress. They are used for shaping by injection, pressing or extrusion (parts of simple geometry and / or axial symmetry). Their water content depends on the nature of the clay contained in the mineral mixture and the shaping conditions. It varies between 18% (hard paste for extrusion) and 30% (soft paste for pressing) of the mass of dry matter. In all cases, the product is fired before cooking.

FROM PELLETS

The shaping of parts of simple geometry is done by dry pressing. To obtain a high density, a binder is added to the matrix, it is customary to use spherical granules (of 0.1 to 0.5 mm diameter) having a high flowability. The binder is added by granulation or by spraying / dusting. The binder is usually water (or the binder) and is added by mass. It is therefore easier to use for shaping floor or wall tiles.

