

Talking Shop

Plastic ball clays for engobes and smaltobbio

Luc BOURGY - Technology Manager Raw Materials and Ceramics Applications and Cédric POILLY - Technical Support & Projects, Tiles Body, Glaze & Engobe, both Imerys Ceramics, discuss raw material performance.

The performance of raw materials used in engobes and smaltobbio affects the quality of the tile production in two ways: aesthetic and technical properties. The aesthetic requirements are measured after firing and the technical ones are determined by the application technology and the role of the engobe/smaltobbio.

The function of the engobe layer is to improve the finish of the tile surface by acting as an interface between body and glaze. It can be compared to a primer for paints: a primary layer which will prepare the substrate on which one will apply one or several glaze layers to obtain the perfect finish.

Imerys Ceramics' goal is to improve the aesthetic aspects of engobes or smaltobbio so as to obtain:

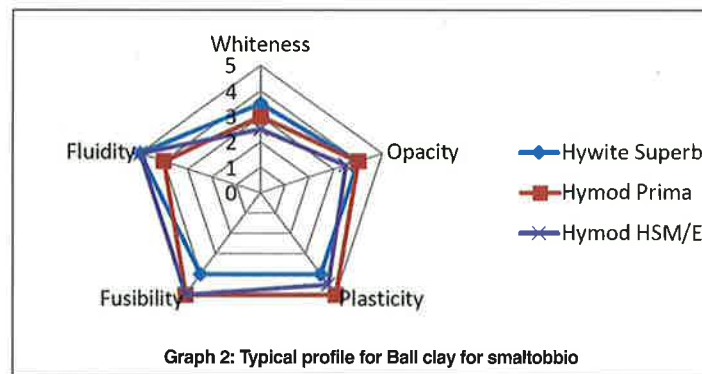
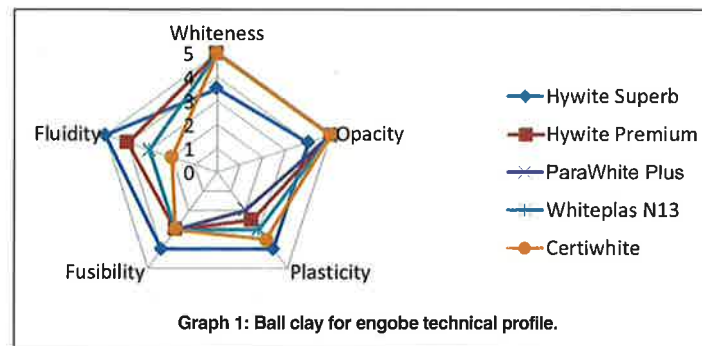
- opacity to enable tile body defects and colour, in particular for red bodies, to be hidden;
- whiteness which is necessary to reveal the glaze depth and the decoration layers;
- flatness & smoothness to improve the glaze finish.

In addition to the final fired properties, the engobe has to be compatible with the application technology and the body formulation. Imerys Ceramics strives to obtain high performance engobe and therefore focuses on the following main technical requirements:

- plasticity which enables the engobe to cover and to adhere to the body surface;
- drying timing, that has to be adapted to the next application on the glazing line;
- pinholes reduction on the glaze surface, by regulating the gases emitted from single-firing bodies;
- fusibility to fill porosity and create an impervious engobe layer which in turn prevents water from penetrating below the glaze surface to create so-called watermarks.

Imerys Ceramics' main challenge is to find raw materials with good performances in all the above listed requirements. Some ball clays, like Hywhite Superb, present a well-balanced profile and results in good level of performance for each parameter. Other clays present different profiles and develop better whiteness like Hywhite Premium, Certiwhite or Whiteplas N13. (cf. Graph 1).

Depending on the desired final requirements, the application technology used and the remainder of the components, the engobe formula can be optimized to obtain higher performances



or be more cost effective.

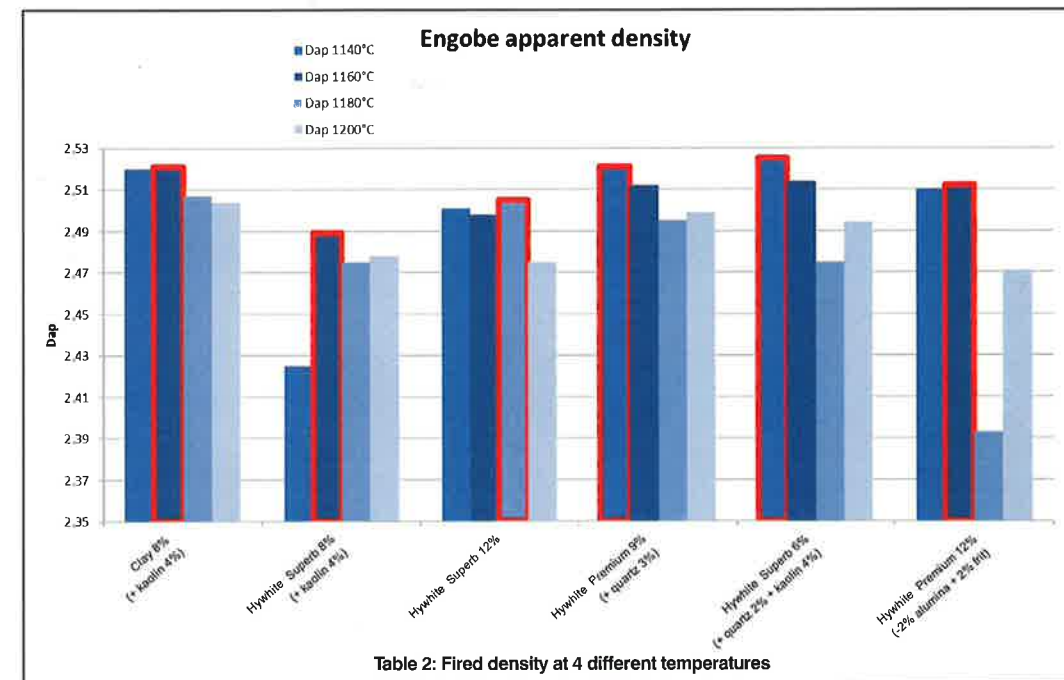
The requirements for smaltobbio are different from the engobe ones. Smaltobbio is a combination of engobe and glaze in a single layer, opaque and mat as an engobe, fused and white as an opaque glaze. The requirements for smaltobbio differ from traditional engobe in the following ways:

- it is usually applied by airless at low density to obtain a thinner layer;
- it must be covering enough the body colour, even with a low thickness, resulting in high opacity;
- the drying time must be long enough in order to allow tile cooling and surface smoothing before going to inkjet printing.

For smaltobbio formula, the ball clays bringing more technical

Table 1: Imerys Ceramics' engobe formula tested

	Standard	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Competitor clay (%)	8	-	-	-	-	-
Hywhite Superb (%)	-	8	12	-	6	-
Hywhite Premium (%)	-	-	-	9	-	12
Kaolin (%)	4	4	-	-	4	-
Quartz (%)	30	30	30	33	32	30
Alumina (%)	3	3	3	3	3	1
Frit 1 (%)	20	20	20	20	20	21
Frit 2 (%)	22	22	22	22	22	23
Zircon (%)	13	13	13	13	13	13
STPP (%)	0.1	0.1	0.1	0.1	0.1	0.1
CMC (%)	0.08	0.08	0.08	0.08	0.08	0.08
Water (%)	41	41	41	41	41	41
Density (g/l)	1.830	1.825	1.830	1.829	1.828	1.826
Ford cup (s)	31	26	23	25	26	26



and economic benefits present a profile where fluidity, plasticity and fusibility are at high levels (cf. Graph 2). Hywhite Superb, Hymod Prima and Hymod HSM/E provide balanced properties, fit for use in smaltobbio formula.

Case study Imerys Ceramics' technical support worked closely with a customer's engobe composition in order to offer a cost effective solution with better technical characteristics. The table 1 shows the different formula tested in order to reach economical and technical targets.

Hywhite Premium presents a lower plasticity, lower fluidity and higher whiteness profile than Hywhite Superb. By introducing Imerys Ceramics' Hywhite clays, the first improvement noticed is lower viscosity. The lower ford cup values allow to have a better control of the density and a better application on the tile.

Imerys Ceramics then used a gas roller kiln to measure the fired properties of the engobe formula. In order to evaluate the sensibility of the formula, different tiles with the engobe were fired at 4 different temperatures. This procedure allowed to understand

the optimum firing conditions to obtain the maximum benefits of the ball clays' performances. Table 2 shows the firing profile to reach the maximum fired density for the different formula tested.

In order to combine better performances and more cost effective recipes, Imerys Ceramics modified the engobe formula by working on several components. The quartz content was increased in the composition (orange and blue curves), thus reducing the overall engobe cost and improving both fusibility and whiteness (cf. Graph 3).

Imerys Ceramics succeeded in offering compositions with significantly higher whiteness and better fusibility (cf. Table 2 and Graph 3).

Choosing the right clay is critical to maximize engobe yield as it impacts on:

- Whiteness & opacity;
- Fusibility & watermark;
- Plasticity;
- Cost.

In order to boost the properties of its minerals and foster innovation, Imerys Ceramics has set up major ceramic technology centres in Europe and Asia. Blending platforms and R&D facilities located near ceramic clusters enable their technicians to provide technical assistance and develop made-to-measure formulations to sustain its customers' development.

