Refractory Zone

Splitting hairs

In the latest of his exclusive articles for Asian Glass, P. Carlo Ratto discusses fused cast refractories, the old friends of glass furnaces, are now coming in different “flavours”…

Furnaces for primary production of glasses, and particularly for the larger volume segments (containers, tableware, float), in spite of great evolution in terms of design and productivity, are still lined with fundamentally two classes of refractories. However, although both are essentially fused-cast, they are now considered commodities.

AZS and aluminas fused cast, with minor reinforcements of some critical detail (like throat inlets, covers, crosswalls, sometime DH corners) are still, in fact, those materials that constitute the melting-end and working-end glass contact, and in several cases also the superstructure.

This situation, now lasting since most recent half of century, is doomed to stay for several years to come, at least until a new and revolutionary smelting technology will support the evolution of a new class of refractory (or no refractories at all), or until some improbable development of a new class of refractories will replace AZS and or aluminas.

I used the word “improbable” because under the present economical contingency (of which we do not see a short term reversal) the resources for a radical R & D development are scarce and because a new class of materials could be welcomed by the glass industry only under a significant economical justification.

Given the combination of furnaces engineering and present fused cast refractories, in fact, the campaign life of advanced furnaces is getting close to the technological obsolescence of the smelting furnace as a general design, so that the motivation for further prolonging the furnace durability is losing momentum, against the purely financial stance.

Having explained why we must expect having to live together for several years with our old classes of fused cast refractories, then we should be seriously interested (maybe concerned?) to understand what technical/technological evolution is going beside the commoditization, welcomed by the market for the obvious cost implications.

In the ante-China era, until a quarter of a century ago, the world was leaving in a technological oligopoly, where in Europe the dominant SG-SEPR was managing the most advanced hot-strip (hs) AZS technology and in North America Monofrax was mastering a very well optimized version of non-hot-strip (nhs) AZS process. These two classes of technology, both with pluses and minuses, were made as effective as possible by manufacturers under a moderate level of competition in a world characterized by an acceptable level of business profitability, and therefore in a scenario leaving some space for R & D activity, not exclusively aimed to cost reduction.

Then, an increased level of competition between the “big western” and, more importantly, the advent of a fierce level of price competition from a bunch of low-cost (Chinese) manufacturers have scrambled the cards in the game; the strategic counter measures of western manufacturers, on a survival stance, have included a radical cost reduction in their own process/technology and, when this proved to be not enough, they resorted to the simplification of the manufacturing process and its progressive relocation in low-cost places.

Since the “nhs” process does not include a critical process step, it was considered to be potentially cheaper and more easily transferrable in exotic locations, where also exist non negligible technology protection implications. Unfortunately, the “nhs” technology implies a more complex molding technology, and this is a point that must be carefully evaluated when balancing cost and quality from a given low cost source and in general: when from a low cost plant of a major western manufacturer and also when produced by an independent (Chinese) player.

Almost invariably, in fact, Chinese manufacturers of AZS fused cast are handling subsets of “nhs” technology, having in common a couple of initial origins and a major technology root, but all relevant to the above mentioned main family.

As a consequence, the “hs” manufacturing process is only staying as heritage of a very few European plants, mostly part of the original SG-SEPR network and one presently operating as RHI-AG unit in Italy.

All relocated low-cost units in China and India, and all the several independent Chinese low-cost manufacturers are in fact running “nhs” technologies. It must be noted that although generally not considered critical by glassmakers, the “nhs” technology implies a larger variability of the associated molding techniques, adopted to fulfill...
the two main functions of the molds: these devices, as a matter of facts, must initially contain the extremely high temperature liquid ceramic and, subsequently, control the passive thermal flow during crystallization and then release of thermo-mechanical stresses, until the cold cast is stripped out of the molding package.

The second function, in fact, is not provided by casting molds, when the "hs" technique is utilized.

Disregarding the qualitative implications concerning the differences between "hs" and "nhs", what we point up here is that, within the domain of "nhs" technology, significant differences exist amid different producers of AZS fused cast who adopt different molding package designs.

In an increasingly complex environment, glassmakers facing the procurement of fused cast refractories for a major furnace rebuild, are receiving quotations relevant to materials and services with different technological profiles, from customary and new manufacturers, from traditional and relocated manufacturing sites managed by western "historical" producers and by independent suppliers; to add confusion to complication, it is difficult, without a deep knowledge of the underlying technological platform, to understand how different technologies reflect into the expected performance, glass quality and campaign life. In other words, it is very difficult, for a glassmaker without a strong specialized support, to determine the ratio risks/savings relevant to alternative options.

After a long experience of supporting glassmakers' decisions in complicated situations, I can quote a few most frequently posed questions:

**Q1)** I am financially motivated to buy fused-cast refractories from a hard low-cost source (i.e. an independent Chinese manufacturer), of which I have a handful of different proposals. How can I know which one is offering the best ratio savings/risk?

**A1)** It all depends on the level of glassmaker's project sophistication and criticalities; it is definitely not the same story when you are a standard bottles-maker or producing perfumery bottles, or handling an all-electrical opal glass furnace. Not all the hard low-cost sources are alike and a thorough analysis of the specific situation will be able to minimize risks while cashing in the best financial benefit.

**Q2)** I am a customer of a major western manufacturer who, in the past, provided successfully fused cast refractories from a relocated low-cost source. Now the same manufacturer is offering same materials from a new alternative low-cost source; how can I be assured that this new source is providing materials and services at a qualitative level at least not inferior to the one I was used to receive?

**A2)** Normally, such major western manufacturers provide reassurance that their relocated plants provide goods and services under corporate qualitative standards, and new plants undergo rigorous internal qualification processes before to deliver products and services at the market level. In spite of this, a given glassmaker is perfectly legitimated to directly check the situation before to proceed with procurement from a new source of an old supplier.

To get to the point, independent audits are available covering the general situation or to be focused on specific aspects of interest for a given glassmaker.

**Q3)** I am a glassmaker producing items with very high and specific qualitative demands. I know that products made out of relocated low-cost and, even more, from hard low-cost sources are not exactly manufactured with same technology managed by original western producers. Does this imply different process capabilities that can reflect in differences of performance for my furnaces? If yes, how can I manage the situation?

**A3)** Two questions require separate answers: as above said, yes, relocated plants are all running "nhs" technology, while some major western (European) plant still are running "hs" technology and, yes, this reflects potentially in slightly different process capabilities. To quote one detail as an example, "hs" technology, separating physically the pouring mold from the annealing package, offers one additional degree of freedom, potentially allowing to manage more critical chemistries (e.g. AZS with more acid and hard glassy phase), and therefore making it possible to offer better performances (e.g. durability) in very critical applications.

When this is significantly important for a specific critical demand, then selected items can be provided out of still operational western plants operating "hs" technology. The most typical situation is when glassmakers buy AZS refractories from relocated low-cost plants of the same supplier.

Selecting if and what furnace details should be selectively procured is a matter of knowledge.

**Q4)** My preferred supplier of fused cast is quoting my BOM out of his relocated plant in China at a price higher than what I can source out of my independent western supplier. Is there any reason for me to buy Chinese stuff from my preferred western supplier?

**A4)** In general terms, Chinese refractory products provided out of a relocated plant (of a major western company) are different from those manufactured by independent Chinese manufacturers, since in the first case the mother company provides all the technical and technological know-how in order to provide materials and (equally important) services at the level necessary to provide global guarantees. In the second case, in spite of managing the same "nhs" class of technology, the global level of technology is not certified against a world level and must be evaluated case by case; very often the independent suppliers can offer a better pricing position but, as previously stated, it is all to be balanced with the specific application and the acceptable level of risk.

AZS fused cast refractories, the old friends of glass furnaces, one major resource that fueled technological evolution toward longer campaigns and much better glass quality, are still around and will be here for many more years to come.

Yet the globalization of markets, the advent of eastern independent low-cost manufacturers and the subsequent commoditization of such formerly specialties is bringing about a serious number of issues for glassmakers having to make the right choice, balancing financial, safety and performance requirements.

Answers are available in such a very dynamic scenario, new options are surely in the pipeline and all actors in this game must be ready to capture opportunities, and to discard excessive risks.