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No Refractories, No Life: A New Look at the Strategic Role of Ceramics Refractories in Modern Life

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Refractory offerings have undergone significant transformations over the years, substantially impacting the way refractories are developed and sold.

Viewing this evolution in a timeline starting decades ago with the first development of refractories, we can highlight, to this day, the most important milestones of this transformation:

- **Product as Proposal:** In this case, the refractories offering was merely transactional, with only price responses (quotes) for volumes established by the buyer (demand). Guided by the “more steel, more refractories” mindset, refractory producers traded their products with a commodity bias.
- **Product as Performance:** With the increase in competition/players offering refractories, there was a need to distinguish oneself from the competition and, to this end, investments in research and development were intensified, resulting in significant advances in product performance. With a mindset changing to “more steel, less refractories” relationships with customers became closer, the offer more solution-oriented with more engineering on board. As a side effect, there was a significant reduction in refractory volumes, given the decrease in specific refractory consumption due to increased performance. This decrease in volume, sometimes masked by the increase in steel production around the world, was also accompanied by a drop in prices—all in the name of “competitiveness.”
- **Product as Purpose:** To make offers more profitable and seek more assertive developments, the Customer Focus solutions approach was initiated. Refractory producers began

to seek more and more knowledge in metallurgy, including hiring former customers. At this moment, the mindset changed to “no refractories, no steel,” with a significant increase in the understanding of the responsibility of refractories in the steelmaking process (which goes beyond the tiny participation in the cost of the slab, which is 3 to 5%). Relationships developed in a network—several areas within the customer became involved—and the offer became more oriented toward the value proposition. As a positive effect, given the greater understanding of the responsibility and impact of refractories on the process and the quality of the steel produced, the customer’s sensitivity to refractory price decreased.

With the development of value-oriented offerings, which began with the adoption of the “no refractories, no steel” mentality, the refractories market started to adopt a market-in approach, evolving from the previous product-out approach. Product-out is a type of mentality that leads to a scenario where the company follows standards but is not concerned with consumer needs. In market-in, in turn, the company implements a mechanism to study consumer demand and, only then, makes the necessary developments to address solutions. A product-out approach will be compromised by an unexpected change in the customer’s preference/need, which could lead to business discontinuity.

The change from product-out to market-in brings a series of positive effects to the sector, such as more business-oriented R&D—so-called business R&D—with investments focused on expanding the state of the art in technology and knowledge, resulting in a higher frequency of disruptions. It is also more

effective in reading and preventing sudden changes from customers. The essence of market-in lies in what Heiki Miki, Shinagawa Overseas Business Division Director, highlights in his speeches: Proximity!

With the more intense use of the concept of proximity to the customer, it was possible to anticipate changes in its processes: whether in response to the reduction in raw material quality for steel production, due to the demand for new types of steel, or mainly by the global demand for the decarbonization of industry. The last five years have shown rapid and enormous progress in this regard, much greater and more significant than that recorded in the previous 20 years.

Proximity, therefore, brings ultra-positive effects: understanding the sector's requirements beyond the customers' point of view! In fact, it is possible to understand from the customer's customer focus. There are several tools that can be adopted for this anticipation, one of which is the use of megatrends. Megatrends are widespread (i.e., global in scope) and long-term social, economic, environmental, political, or technological changes that take time to form but have a major impact once implemented. Climate change and the urgency for a greener world appear in 100% of megatrend reports released worldwide (whether by banks, the United Nations, universities, etc.).

Focusing on the role of industry in decarbonization is where the "no refractories, no life" mindset lives and gives rise to the assumptions of the projects developed at Shinagawa. This new mindset is not limited to looking at carbon emissions only in terms of the refractory industry but rather to understanding that the fight against carbon emissions will not be done without the development of new refractory technologies that must have—as a principle—the elimination of aggressive steps from the customer's production process.

Some examples of this rationale in ongoing projects at Shinagawa (which were recently presented both at the Pan-American Ceramics Congress by R&D Director Douglas Galesi and at IREFCON 2024 by Commercial and Marketing Director Danilo Bomfim) are:

- **Dryingless Castable:** The drying stage of refractory castable is equivalent to hours of equipment downtime in steel mills each year. By cutting this task out, all carbon emissions generated during drying are eliminated (estimated at 1 kton/year for the production of 4.5 Mton of pig iron). The elimination of this step also results in increased productivity, which is equivalent to a reduction in the total cost of pig iron production. According to Heloisa Orsolini, R&D Supervisor,

the concept involving this technology—which is already in the BestDrying line for Blast Furnace Trough & Runners—will be expanded to 100% of Shinagawa's castable portfolio (including the entire steel and industrial markets, such as cement).

- **Unfired Bricks:** By eliminating the firing stage (responsible for up to 69% of carbon emissions in the production of fired bricks), all carbon emissions from this stage are eliminated. This technology is already a reality for Shinagawa's MgO-Spinel bricks for RH Degasser and has been expanded to 100% of the brick lines that are currently fired.

In addition to the concept of eliminating production steps (with a focus on reducing carbon emissions), Shinagawa has developed disruptive solutions aimed at increasing metal yield and energy saving, which also result in a greener production process for the steel industry, such as:

- **Self-Healing Refractories:** Shinagawa's HealBorn line, recently launched, maximizes energy conservation in vessels such as torpedo cars and pig iron ladles, being essential for the delivery of hotter pig iron to the steelmaking area. This is possible with the simple reduction/removal of carbon from the ACS refractory formulation. This finds strong appeal, among other things, with the growing demand for the use of scrap (cold charge) in BOF—a crucial topic of decarbonization. As an effect of removing carbon from the brick formulation, cracks occur (due to thermal shock), which are completely resolved by self-healing technology. According to the Technical Manager for Iron & Steel, Eric Sako, HealBorn technology has been used successfully in torpedo cars and pig iron ladles, with advanced research for use in 100% of applications, whether in castables or bricks.
- **C-Free Bricks:** ALTIMA technology has been successfully incorporated into Shinagawa's BlendBowl line for steel ladle linings. According to the Innovation Projects Manager, Haysler Apolinário Amoroso de Lima, the gain in energy savings has allowed customers to reduce the tap temperature of BOFs by more than 10°C. Currently, the Brazilian market has more than 60% of integrated mills using this technology (5 years ago, this did not reach 20%) with significant reductions in carbon emissions and slab costs.

Shinagawa continues its developments with and for the customer, taking the "no refractories, no life" mindset as the necessary inspiration, understanding its role in this global decarbonization challenge, modernizing its manufacturing units, and investing in increasing knowledge and technology in its facilities and research centers around the world. ■