

100 周年記念号発刊にあたって

In Publishing the 100th Anniversary Issue

松井泰次郎*

Taijiro MATSUI

1 緒言

当社は、2019 年 6 月に創業 100 周年¹⁾を迎えました。大正の世に創業した当社が、昭和、平成と二つの時代を乗り越え、令和という新しい時代の幕開けと共に記念すべき年を迎えました。この大きな節目を迎えることが出来たのも、各客先の皆様を始め、各関係先及び諸先輩方々の温かいご指導とご支援の賜物であり、深くお礼申し上げます。

本稿では、創業 100 周年記念号に際し、この四半世紀の当社技術を振り返ると共に今後の耐火物技術について展望致します。

2 この四半世紀における耐火物産業の発展

1990 年代初期においては、国内経済情勢はバブルが崩壊し最大の顧客である鉄鋼業においても国内年間粗鋼生産量が 1 億 t を割りこみ高炉大手の製鐵所では、一部の高炉休止が断行され耐火物業界も氷河期の真只中を迎えていた時期である。

このような経済情勢下で国内の企業再編だけでは固定費を吸収するに至らず「グローバル展開と技術革新」が叫ばれる平成の時代へと歩み始めた。この四半世紀の主な技術指標の変化について表 1 に示す。この当時の国内耐火物生産量は約 168 万 t / 年²⁾で鉄鋼業における耐火物消費原単位は約 11.6 kg / t-s であった。

その後、四半世紀が経過し耐火物を取り巻く環境が大きく変化した現在、当時の諸先輩方々による抜本的な生産構造改革、新規事業分野への参画、各種材料技術開発及び新規製造設備の導入により、近年の成長を成し遂げるに至っている。鉄鋼業における耐火物消費原単位は約 9.18 kg / t-s にまで確実に向上しており、日本鉄鋼業の発展に大きく貢献して来た。

1. Introduction

In June 2019, Krosaki Harima celebrated its 100th anniversary¹⁾. Our company, founded in the 'Taisho' era has overcome two eras, 'Showa' and 'Heisei' and reached a memorable year with the beginning of a new era called 'Reiwa'. With the appropriate guidance and support of our customers and our seniors, we were able to reach this major milestone. Thank you very much.

In this article, the refractory technology of our company in the past quarter century is reviewed, and the future prospect is described as the 100th anniversary issue.

2. Progress of the refractory industry in this quarter century

In the early 1990s, the bubble economy collapsed in Japan and the annual crude steel production fell below 100 million tons, and some blast furnaces were shut down at the major blast furnace mills, and the refractory industry entered the ice age.

In such an economic situation, the restructuring of domestic enterprises alone could not sufficient to absorb fixed costs, and the transition to the Heisei era, which "Global expansion and technological innovation" was sought, began. Table 1 shows changes in major technical indexes over the last quarter century.

Domestic refractory production at that time was about 1.68 million tons / year²⁾, and the refractory consumption basic unit in the steel industry was about 11.6 kg / t-s.

Since then, the environment surrounding refractories has changed drastically, and the recent growth has been achieved by drastic production structural reforms, participation in new business fields, and development of various material technologies and introduction of new manufacturing equipment by seniors at that time. The refractory consumption basic unit in the steel industry has improved to about 9.18 kg / t-s, which has greatly contributed to the development of the Japanese steel industry.

* 常務執行役員 Managing Corporate Officer

3 今後の耐火物技術の展望

直近の米中貿易摩擦や新興国経済情勢の急速な変化等に加え、消費増税から国内製造業の需要減と耐火物業界についてもマイナス要因が輻輳し、1990年代以上に国内粗鋼生産量の減少が懸念されている。このような耐火物業界を取り巻く環境を踏まえ、四半世紀後の2045年以降も更なる持続的成長をなし得るための主な施策と耐火物技術を展望する。今後の中長期を展望した際、最大の課題と考えられる労働生産人口の減少³⁾(2045年予測5,584万人)への対応については、これまで労働・生産に従事されていなかった女性やシニア層の雇用を促すような働きやすい環境づくりに配慮し、自動化・機械化をロボット、ICT、AI技術等を駆使し生産性向上を狙った製造プロセスを構築すると共に、働く人の成長を後押しする価値観・企業風土の醸成が最重要である。

一方、技術的には創業の精神「より良く、より早く、より安く」を基本に世界一の顧客価値の実現を目指す事には変わりなく、地球環境にも十分配慮し顧客ニーズを先取りした取り組みの推進が重要である。今後とも高温下で健全な窯炉設備を提供し続ける為に以下の3点を提唱したい。

- 1) 炉体性能を最大発揮するための操炉方法まで踏み込んだ炉構造・設計技術の構築
- 2) 更なる高耐火性の新素材の適用と耐火粒子の加圧集合体ではなく組織制御された成形体の追及
- 3) 技能の見える化・デジタル化による確実な伝承⁴⁾と炉設備の築炉・施工及び補修・診断作業の進化

4 結言

最後に黒崎播磨グループはこの100周年を機に更なる発展を目指し、「100年の技術を未来へ」向けて、新たな挑戦を続けて参りますので、今後とも黒崎播磨グループの一層の発展にご協力・ご支援頂くことをお願いし末筆と致します。

3. Future prospects for refractory technology

There are concerns that domestic crude steel production will fall to the early 1990 levels due to such factors as the recent trade friction between the United States and China, rapid changes in the economies of emerging countries, and a decline in domestic demand associated with a consumption tax hike.

In such an environment surrounding the refractory industry, the main measures and prospects for refractory technology to achieve further sustainable growth after 2045 a quarter century later. The biggest problem in the medium to long term is that the labor productivity population³⁾ is projected to decrease to 55.84 million by 2045.

In response to this issue, a comfortable working environment that promotes employment of women and the elderly who are not engaged in labor or production should be developed, and manufacturing processes that aim to improve productivity should be constructed by utilizing robots, ICT, AI technologies, etc. for automation and mechanization and the most important things are to foster values and a corporate culture that support the growth of workers.

On the other hand, the goal is to provide No.1 value to customer worldwide based on the founding spirit of 'better, faster and cheaper' and it is important to promote initiatives that anticipate customer needs with due consideration to the global environment. In the future, I would like to propose the following three points in order to continue to provide robust and durable furnace at high temperatures.

- 1) Construction of furnace structure and design technology including furnace operation method to maximize furnace performance
- 2) Application of new materials with higher temperature resistance and the research of structure-controlled compacts rather than pressurized aggregates of refractory particles
- 3) Reliable passing on skills through visualization and digitization⁴⁾ and progress of furnace construction, repair and diagnostic technique

4. Summary

Finally, the Krosaki Harima Group will continue to take on the new challenge of 'applying 100 years of technology to the future' with the aim of further development on the occasion of this 100th anniversary. We would like to ask for your continued cooperation and support for the further development of the Krosaki Harima Group.

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Table 1 Changes in major technical indexes over the last quarter century¹⁾

Items		A quarter century ago (Average from 1990 to 1993)	2018	Changes during the quarter century
Domestic crude steel production / $10^6 \text{ t} \cdot \text{year}^{-1}$		103	104	No apparent change
Domestic production of refractories / $10^6 \text{ t} \cdot \text{year}^{-1}$		1,767	1,051	40 % decrease
Imported refractory materials / $10^6 \text{ t} \cdot \text{year}^{-1}$		32.4	352.9	Approximately 10 times
Production of our company refractories / $10^3 \text{ t} \cdot \text{year}^{-1}$		169.1	346.9	Approximately twice (including merger / reorganization)
Our consolidated results performance / 10^9 yen	Net sales	61.40	142.35	2.3 times
	Profit	0.16	7.87	49.2 times
Our overseas sales ratio / %		10	35	25 % growth
Employees (Consolidated) / people		1,593 (2,210)	1,329 (4,439)	Approximately twice
material	Brick	Spread of ASC bricks for torpedo car ladle	MgO-C with less characterization change	From chemical component system improvement to structural optimization
	Monolithic	zircon materials $\Rightarrow$ alumina spinel or magnesia materials	Dense castable for teeming ladle	Rising price of zircon raw materials
	Flow control	Alumina graphite nozzle	Dolomite graphite nozzle	Prevention from nozzle clogging
	Insulation	Refractory fiber ($\text{Al}_2\text{O}_3\text{-SiO}_2$ fiber)	Soluble fiber	Amendments to the law in November 2015
Unit consumption of refractories in the domestic steel industry / $\text{kg} \cdot \text{t} \cdot \text{s}^{-1}$		11.6	9.18	Improvement of approximately 20 %
Furnace construction and repair technology		Introduction of new cleat technology	Innovations in SN switches	Working environment, labor-saving measures
Manufacturing facility		Introduction of large-scale CIP	Introduction of advanced large press equipment	Increased pressure and densification
Changes in the organizational structure		Fine Ceramics Division established	ICT Department established	Organizing according to needs
Domestic labor production population / 10^6 people		85.9	73.4	14.6 % decrease