Dear Partner,

It gives me great pleasure to present to you, The Refractory Beat. It’s your window into the world of Dalmia-OCL and its associated businesses, including the well-known GSB Group and the all-new Dalmia Seven, our joint venture in India with Europe’s monolithics specialist, Seven Refractories.

Some of you may already know what Dalmia-OCL is and what it brings to steelmakers around the world. Capabilities spanning refractory design, manufacturing, application and management. And a product range as wide and diverse only a few refractory companies in the world are able to offer. With a total of 700+ SKUs, Dalmia-OCL offers shaped and unshaped refractories of all kinds for a variety of equipment and processes – coke ovens, blast furnaces, transportation (all types of ladles), primary and secondary steel making, flux control and casting. Be it a fresh installation, or refractories for repair and maintenance, Dalmia-OCL works with leading steelmakers and OEMs in both India and across the world, to ensure its refractories provide the critical lining support steelmakers expect from the best around the world.

Dalmia-OCL is the lead brand representing the refractories business of India’s $1.7 billion Dalmia Bharat Group. Our facilities span five raw material mines, seven manufacturing plants in India, China and Germany, and a specialized refractory R&D Centre in India which even collaborated with India’s ISRO (Indian Space Research Organisation) for development of rocket ceramics at one stage. Dalmia-OCL caters to multiple industrial segments such as Cement, Glass, Non-Ferrous metals, Power & Petrochemicals, aside from Iron & Steel of course. Refractory business I feel is more a people business than anything else, a fact vindicated by long buying, testing, application and performance cycles. Human resource is the glue that keeps it all together. Dalmia-OCL currently has a talent pool with 6,000+ man-years of diverse, rich and proven refractory experience, which is rapidly growing thanks to its global expansion, via both organic and inorganic means. Over the last 70 years or so, Dalmia-OCL has worked

LANCE INNOVATIONS
FROM A EUROPEAN CHAMPION

By Kumar Subramaniam

INTRODUCTION

Refractory lances are an integral part of clean steel making, being used in both primary and secondary metallurgy. These have come a long way today from the time of its first development. The first lance designs were essentially a steel pipe surrounded by refractory ring, shaped bricks fixed with mortar. GSB Group takes pride in the fact that they were one of the first during the 1970s to produce monolithic lances in continental Europe, meanwhile having emerged as a true global leader in terms of quality and quantity in the field of lance technology.

IRON LANCES

One of primary steps in improving the quality of steel is to reduce its sulphur content, as sulphur is one of the most detrimental impurities in steel making process, affecting both internal and external qualities. Classical de-sulphurisation process involves injection of a range of fine powders like lime, calcium carbide and magnesium, which are chosen depending on local conditions with a refractory lance immersed into an open ladle or a torpedo ladle car. The most suitable vessel for hot metal de-sulphurisation are the iron transfer ladles, because of its shape, which makes it much easier to de-slack compared to a torpedo. From the refractory lance
AS FAR AS STEEL LADLE LININGS GO

DALMIA-OCL SPOILS YOU FOR CHOICE

India's fastest growing refractory company gives you up to 5 options including bricks, monolithics or a mix of both to choose from for deploying an optimal lining for higher performance and benefits associated with it such as ladles remaining in circulation for a longer time, shorter downtimes and reduction in overall costs.

Traditionally steelmakers have relied on镁Carbon bricks for lining up ladle bottoms, metal zone and slag zone. With advancements in monolithics, steelmakers can now expect more than just repair and maintenance from utilisable. Automation is slowly merging into these new practices and monolithics can now be used for replacing, even building ladle bottoms and metal zone sidewalls for longer campaign cycles. What's more, these new monolithic options allow for additional benefits such as the ability to make cleaner steel and very low carbon pickup. Dalmia Seven goes on to promise an endless lining through its products and services portfolio. Read on to learn more.

ADVANCED MONOLITHIC SOLUTIONS FOR STEEL LADLES

Dalmia Seven offers steelmakers multiple monolithic approaches as an alternative to classical mud and brick lining. The transition to a progressive adoption of a monolithic solution brings several advantages in terms of performance, consumption and most importantly, the economics of the entire steel production cycle.

Options include
- A monolithic working lining of the ladle bottom (instead of the original brick lining) with the application of self-flowing castables. It is a very easy and comfortable technique accompanied by no vibrations, no moulds and no requirement of any specialised manpower.
- A full monolithic working lining of the steel ladle (bottom and sidewalls) with the application of self-flowing as well as elevating castables. A complete and versatile solution, this option is highly reliable and has proven itself at multiple locations across the globe.
- Application of monolithic castables by shotcreting to form a protective layer. A versatile solution, this option is highly reliable and has proven itself at multiple locations across the globe.

Advantages
- Endless lining: continuous repairs instead of material substitutions
- Reduction in material consumption (in absolute as well as specific terms)
- Application of monolithic castables by shotcreting to form a protective layer
- A versatile solution, this option is highly reliable and has proven itself at multiple locations across the globe.

Background
Tata Steel’s Refractory Engineering Department at their newly commissioned Kalinga Nagar plant in Odisha, India was tasked with attaining highest lining life for their steel ladles. Tata Steel worked closely with multiple refractory makers including Dalmia-OCL, to find ways of improving lining life without compromising on safety, reliability and productivity.

Dalmia-OCL, proposed using AluSpin 95 for the ladle’s metal zone. And the results were fantastic. AluSpin 95 checked all the boxes as far as the objectives of this exercise were concerned:
1) Achievement of higher lining life leading to reduced down time, faster turnover (owing to second slag zone repair in lieu of re-lining), fuel economy (on account of less pre-heating duration) and utilization of each segment of lining to its fullest potential.
2) Better volume stability and lower conductivity resulted in slower volume contraction and reduced impact of bath turbulence arising while purging of gases via porous plugs or slavon. Residence time of hot metal intensified stirring in ladle.

In the process, the ladle attained its highest-ever life of 168 heats with AluSpin 95 lining up its metal zone, a record for the shop. The benefits included improvement in different metrics such as lesser number of ladles in circulation, more heats per ladle per day, less refractory salvage generation due to lower specific consumption of refractory, better inventory management and reduction in overall refractory cost.

Further development
The technology and product development team at Dalmia-OCL, has now introduced an intermediate quality brick for the Slag Zone – Metal Zone interface. Initial results are encouraging. Moreover, with rationalisation of lining quality, optimisation of working thickness in various zones like purging, non-purging side and improvement at interface zone, AluSpin 95 is all set to scale newer heights in crossing even higher benchmarks.
A North American steel mill approached GSB Group to improve performance of their iron de-sulphurisation lances that happens in a Torpedo Ladle car through a single straight hole. GSB Group successfully designed a twin port “T” hole which resulted in almost 60% percent refractory performance improvement as well as 25% improved operational efficiency in terms of reduced consumption of re-agents, and reduction in injection time per heat.

**STEEL LANCES**

Clean steel necessitates different characteristics depending on the need and properties required for the final product. Some secondary metalurgy steps like de-oxidation, prevention of re-phosphorisation, deep de-sulphurisation are carried out using a refractory lance for two main purposes. Firstly, for the hot metal lances, the main focus is on refining their processes to produce better and cleaner steel. The role of different types of refractory lances is of high significance in the world of steel making. The contributions of GSB Group in terms of continuous innovation has lead to the development of Slit lances and Purging Plug fitted lances, which guarantee enhanced performance and operational reliability providing a cutting edge to global steel makers.

**CONCLUSION**

Increased quality requirements and demands continue to drive steelmakers to refine their processes to produce better and cleaner steel. The role of different types of refractory lances is of high significance in the world of steel making. The contributions of GSB Group in terms of continuous innovation has lead to the development of Slit lances and Purging Plug fitted lances, which guarantee enhanced performance and operational reliability providing a cutting edge to global steel makers.

**OPPORTUNITIES TO ENHANCE PERFORMANCE**

• Lower consumption of injection gases
• Smaller and finer bubble size for process efficiency
• Improved lance performance
• Lower consumption of injection gases

**Low cost per tonne**

The ability to avoid ladle life drops therefore always improving life and minimizing risk to the steel plant and at the lowest cost/tonne.

**The Case for Collaboration between Steelmakers and Refractory Suppliers**

The question for many years has been how to get the best refractory ladle lining design that maximizes lifetime, while minimizing risk to the steel plant and at the lowest cost/tonne. (Advances in refractories 2010, 5th international symposium, The Michel Rigaud symposium, Mazzetti, V)

The steel industry continues to drive to higher life and lower cost/tonne. (Advances in refractories 2010, 5th international symposium, The Michel Rigaud symposium, Mazzetti, V)

The best solution is a collaborative team made up of a steel operations process engineer, a steel plant refractory technologist, an installer representative, a refractory technical support person and a refractory R&D person that would drive to the optimized solution and common goal.

This type of team can work on a customized solution since each plant and process route is different and there are no generic answers. Historically, plants with this approach have the following benefits:

• Larger heat sizes through safety lining redesign without increased risk to ladle breakouts
• Balanced ladle life whereby the slag-line, metal line, bottom and blocks all wear evenly and no refractory is wasted
• The ability to avoid ladle life drops due to new process changes by designing changes proactively and therefore always improving
• Partnerships that can increase life and decrease cost/tonne by 5% per year each year

**About the Author**

Tom Vert is the author of “Refractory Material Solution for Steelmaking” and a recognized world refractory expert with a demonstrated history of working in the Steelmaking industry. Tom Vert has led major successful improvements in safety, environmental, productivity, cost and quality performance through a team based approach using “one strength is people” approach.