HORIZON
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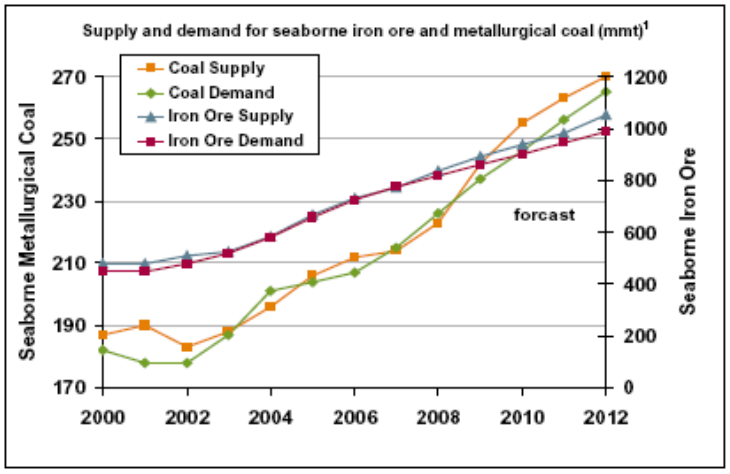
STEEL FACTS: BELIEVE IT!

The integrated steel making route, based on the Blast Furnace (BF) and Basic Oxygen Furnace (BOF) uses 1725 Kg of iron ore, 645 Kg of coal, 150 Kg of limestone and 138 Kg of recycled steel to produce a ton of crude steel. The Electric Arc Furnace (EAF) route uses 1050 Kg of recycled steel or direct reduced iron (DRI), 65 Kg of coal and 43 Kg of limestone to produce a ton of crude steel. In 2009, 1.5 billion tons of steel were produced and production levels are expected to double by 2050 to meet the growing demand for steel around the world. Worldwide available iron ore resources are estimated to be 800,000 million metric tons (mmt), containing about 230,000 mmt of iron. Annually, 592 mmt of coal or 12% of total hard coal consumption are used for steel production. World reserves in coking coal are estimated to last for 100 years.



ENVIRONMENT CHECK !

Chinese Government may impose a carbon tax on the steelmakers of China by 2012, at a rate of $1.5-3 per ton of carbon dioxide emissions.

From Editor's Pen

Once again the growth story of Indian economy is making news as the PMEAC has stressed that our economy is expected to grow faster than expected 8.5 percent, if inflation is reined. It will be pushed up by 4.5 percent in agriculture, 4.5 percent in services and 9.3 percent in industry. With more than normal monsoon forecast the horizon looks green and promising and inflation may decline down to 6.5 percent. Exports are projected to grow by 22 percent on the back of recovery in global trade. The decontrol of petrol prices would no doubt fuel higher inflation as the price alignment was long overdue. But the 9 percent growth expected may be subdued by infrastructure bottlenecks, especially power. Overall Asia's emerging markets are all poised to lead the global expansion in steel. World Steel Association has predicted that global GDP growth will go on gaining momentum till 2012 and maintain it till 2014. Growth forecasts have brought forward expectations of Asian steel demand reaching 1.0 billion tons in 2012 from 803 million in 2009. Steel consumption in India has jumped up by 8 percent last fiscal. As most leading players are pitching strongly for iron ore and coal security the competition for green field expansion is getting overheated. Crude steel capacity in India is expected to rise by 9 percent to 71mtpa and by another 9 percent in 2011 with Essar, Bhusan, SAIL and Tata Steel adding significant capacity. The refractory industry landscape looks pretty charged up with most of the players adding to existing capacity by capacity augmentation and outsourcing and ready to take on the tide. The raw material supply and price segment looks heated up with another round of price rise in alumina materials. At OCL the commissioning of Basic burnt plant in China and standardization of Dolomite brick operation has put things in right perspective. With export market of CC refractories, Slide gate and Purging Plug is showing good turnaround, there is an air of expectancy for long haul in spite of shrunk returns. Happy reading.

SK. BASHIR MOHAMMED

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What's inside

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MOVEMENTS ON THE GLOBAL STEEL FRONT...

JFE Holdings, the second largest steelmaker of Japan, has planned to invest $2.2 billion in iron ore & coal mines of Australia and Brazil to attain its self sufficiency in raw materials. Exports for JFE rose to a record 50% this fiscal year as compared to 46% last year. JFE is likely to collaborate with JSW Steel in India on automobile steel production.

Japan will remain as the world's second largest producer of steel after China by increasing its crude steel production to 105 million tons in this fiscal year, which is an increase of 9% from last year's production of 96.5 million tons.

Nippon Steel, world's second largest steelmaker, will make a joint venture with Ternium in Mexico for supplying automobile steel. This US$350 million project will have a capacity of 400,000 tons per annum. It has also planned to increase the volume of its No.2 furnace from 3272 cu m to 4500 cu m by 2012 which will increase its raw steel capacity by 700,000 tons per year.

Kobe steel of Japan is on a move to construct US$1 billion iron production facility in Vietnam.

Vietnam has successfully initiated their first ever soft iron production in Mirex Cao Bang Mining & Metallurgy complex. This project applies new technologies in producing soft iron and alloy steel with a capacity of 100 tons per year for each item.

Sahaviriya Steel Industries, one of the steel giants of Thailand, expects to increase its capacity from 1.75 million tones at present to 2.7 million tones in 20111 and finally to 3.1 million tones by 2012.

Hyundai Steel of South Korea has started production from its first ever integrated blast furnace after spending US$5.55 billion on this project with an annual production capacity of 4 million tons.

China's Anshan Iron & Steel Group will invest $175 million in a steel mill, now under construction, in Amory, Mississippi, USA.

STEEL & ECONOMY

ASEAN's steel consumption will increase from 42 million tones in 2009 to 45 million tones in 2010 and further to 49 million tones in 2011. World Steel Association has predicted that US economy will show a growth of 3% in 2010 and improve further in 2012. European countries will face a slow recovery. However, the Asian economy will show a healthy growth. Both China & India will enjoy a GDP growth rate of above 8% annually in 2011.

INDIAN STEEL FRONT: PICTURE OF GROWTH

India's per capita steel consumption is around 46 Kg as against the global average of 198 Kg. Steel consumption has grown by 8% in the fiscal year ended March 2010. In this period, India's steel consumption has increased to 56.3 million tones as compared to last year's figure of 52.3 million tones.

JSW has reported a 20% growth in crude steel production in April 2010 as compared with the same period last year. The output of its products for automobile and infrastructure industries have increased by 28% and 86% respectively in April, 2010. The company has started production from its 3.5 MTPA hot strip mill at Vijaynagar works.

SAIL, Tata Steel & Essar have increased their sales by 15% in the fiscal year ending upto March 2010. Total steel production in India in this period has rose to 60 million tones as compared to the last year's figure of 57.6 million tones which is a rise by 4.2%
SAIL is in the process of increasing its production capacity from 14 MTPA to 60 MTPA by 2020. It will initiate the project by expanding the capacity of its plant at Bokaro from 4.5 MTPA to 7.5 MTPA by spending Rs. 70,000 crores.

Indian Government has increased the export tax on iron ore lumps from 10% to 15% to reduce the export, mainly to China, and increase the availability of this raw material for domestic steel plants.

South Korea's POSCO has entered into a joint venture with SAIL for setting up Rs. 15,000 Cr steel plant in Jharkhand.

Japan's Kobe steel has also shown interest for joining hands with SAIL. Tata Steel is also eyeing on collaboration with SAIL for a 2 million ton steel making venture in FINEX technology.

Jindal Steel & Power (JSPL) has started commissioning their 12.5 MTPA mega project at Angul, Orissa which will be completed in 3 phases.

- Compiled by Bashir Mohammed & Anupal Sen

OCL IN MINERALS & METALS SUMMIT 2010

OCL has actively participated in "Minerals & Metals Summit – 2010" on 5th-6th May'2010 at Hotel Swosti Premium, Bhubaneswar. This international seminar was organized by .....

ISR Conferences & Services. Several renowned corporate miners, steelmakers and refractory manufacturers along with eminent researchers and academicians gathered on this occasion. Mr. D.C. Daspatnaik, Mr. M. Mustafa and Mr. Anupal Sen participated in this event. Mr. Sen presented a paper on “Raw Materials for Refractories”, highlighting future scope of materials development.

CASE STUDY:

ANALYSIS OF PROBABLE EFFECTS OF BOTTOM PURGING IN STEEL LADLE WITH OXYGEN

If Oxygen is used as purging gas for purging of Liquid steel in the Ladle Furnace instead of any of the inert gases like Argon or Nitrogen through Purging Plug, the following reactions may take place in – situ depending upon the composition of steel in the ladle.

1. $6*Al + 3*O2 = 2* Al2O3 + Heat$
   (Equivalent to 30OC for 0.1% Al in Steel)
2. $Si + O2 = SiO2 + Heat$
   (Equivalent to 27OC for 0.1% Si in Steel)
3. $2*Mn + O2 = 2*MnO + Heat$
   (Equivalent to 9OC for 0.1% Mn in Steel)
4. $2*Fe + O2 = 2*FeO + Heat$
   (Equivalent to 9OC for 0.1% Fe in Steel)

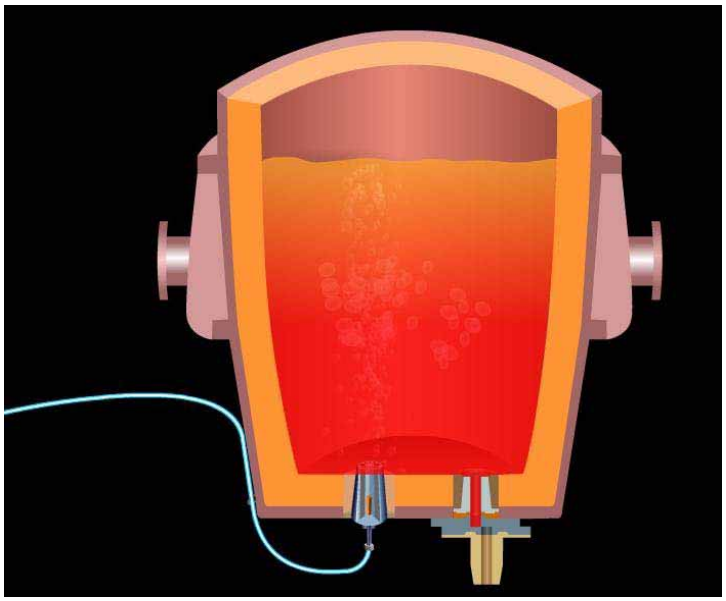
As the metallurgical reactions in a multi - component system take place simultaneously, it is difficult to ascertain the burning of each element at any point of time under production environment.

But, it is a fact that in presence of gaseous Oxygen, the metallic do get oxidize and give rise to temperature increase as is evident from the above reactions.

As the air entry is through Purging plug, the temperature rise will be in the vicinity of the air exit surface of the Purging plug. Also, the oxides thus formed are initially in liquid state mostly and may interact with other oxides to form low melting complexes that are corrosive to refractories and lead to undue and irregular erosion.

Moreover FeO and MnO are liquid at Steelmaking temperatures and do get react with the liquid steel imparting high fluidity and corrosiveness to the liquid steel. With Air purging through Purging plug, it will have severe adverse effect on refractory and to the molten steel under process. The corrosive effects for softening and erosion of Purging plug are:

- Localized high temperatures near the Purging plug top surface as the chemical reactions take place at the exit of Purging plug.
- Erosion of Purging plugs refractory due to Chemical attack by the Metallic Oxides on refractory.
- The SS casing, that is only about 0.8mm thick, get burned in presence of Oxygen in purging air and form liquid FeO that can react with Purging plug refractory and dissolve it. This will create an outlet from which liquid steel can penetrate right up to the bottom of the Ladle shell.



Therefore, it can be concluded that oxygen purging in the ladle can be disastrous for ladle bottom purging.

ENVIRONMENT FRIENDLY !

More steel is recycled worldwide annually than all other materials put together, with an estimated 478 million metric tons (mmt) being recycled in 2009, about 38% of the crude steel produced that year. Recycling of this steel has avoided 827mmt of CO2 emissions, saved 868 mmt of iron ore, and saved the energy equivalent of 242 mmt of anthracite coal.

DEVELOPMENT OF HIGH STRUCTURAL FLEXIBILITY MAG-AL SPINEL BRICK FOR CEMENT ROTARY KILNS

- S C Swain, K B Panda, D Chandra

Cement manufacturing process has undergone a drastic change in the recent past. The wet process has gradually been replaced by the dry process due to increase in demand of production capacity coupled with energy efficiency promoted by necessity to decrease the emission of green house gases. Further, the non availability of good quality coal compelled to focus on low grade coal with high ash and high sulphur content and other source of fuel where alkali, chlorine, sulphur content is very high.

In this changed environment, Mag-chrome bricks are preferred in the burning zone of rotary kilns over conventional high alumina bricks as the former are found to be three times durable than the later in the modified conditions. But, here, the water soluble hexavalent chromium compounds after use pose an environmental issue for its disposal being carcinogenic.

Hence development of chrome free basic bricks, compatible to cement raw mix and severe operating condition with alternating fuel, has been thought of. With this view special magnesia alumina spinel brick has been developed.

Periclase is used because of its low reactivity against the clinkering phases. Spinel is added to magnesia because of its low thermal expansion, low thermal conductivity and high thermal spalling resistance. In addition, the thermal expansion difference between Periclase and Spinel makes the brick structure discontinuous resulting in good thermal flexibility and prevention of crack propagation.

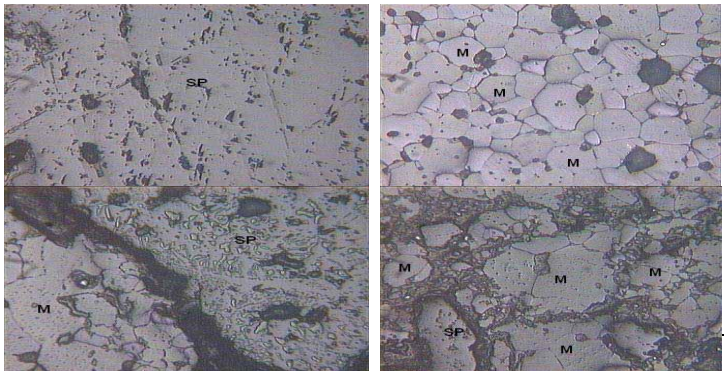
Apart from mechanical fatigue due to kiln rotation , main destructive stresses are:

- Peeling off due to structural spalling owing to infiltration of melting phases of clinker.
- Degradation of microstructure due to reaction of clinkering phases with spinel grains.
- Degradation of microstructure with multiple cracks due to alkali chlorides/sulphate salt infiltration.
- Low structural flexibility

Taking these into to account, Magnesia-alumina spinel brick has been developed by adding fused magnesia with special additives over conventional magnesia-alumina spinel bricks, mostly sintering aids. The comparison of properties between developed and conventional brick is shown below:

Properties	Conventional	Developed
AP%	15,15.6	15.1,15.2
BD (gm/cc)	2.97, 2.98	3.02, 3.03
CCS (kg/cm2)	646,668	765, 814
RUL ta °C	1740	1760
Spalling DIN 51068/2(Cycles)	+100	+100
Permeability npm	8.5	5.3
MOE Gpa	18.7	15.4
MOR (kg/cm2)	122	144
MgO %	87.89	84.84
Al2O3 %	10.25	10.63
Fe2O3 %	0.29	0.43
CaO %	0.7	0.6
SiO2 %	0.47	0.37
ZrO2	-	2.7
Erosion (mm) in rotary drum with clinker, alkali & sulphate	8 (at 1650 deg C)	5 (at 1650 deg C)
Alkali penetration (mm) at 1100 deg C / 48 hours	28	23

Microstructure analysis of the developed brick shows the Periclase grains are euhedral with high degree of direct bonding and hardly there is any silicate phase..



Developed brick is used in a 4m diameter kiln from 18 to 26m with a life of 9 months. After 9 months of service the residual thickness is 150-160mm out of 200mm. The performance of conventional brick in this zone is 5-6 months. Developed brick has been lined in a 2.5m diameter kiln from 6m to 14m where petroleum coke is used as fuel and even after six months of service there is hardly any erosion. In the particular kiln life of 70 % alumina brick is only 15 days.

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