



MOIL LIMITED

Adding Strength to steel.....

**USE OF HIGH GRADE ORE & SINTERS TO REDUCE SPECIFIC
CONSUMPTION OF POWER IS THE NEED OF HOUR FOR SILICO
MANGANESE SMELTING**

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Introduction

- Manganese and Iron are linked due to their complimentary nature in steel production .
- Before they become usable in steel production , both ores undergo processing Manganese ore needs to be processed to alloys . Iron needs to be smelted to metallic form Ferro alloys are important additives in production of steel.
- Growing steel production dictates strong demand for Manganese Alloys.
- Most used Mn based alloy is Silico-Manganese.
- Since specific power per ton of silico manganese produced is comparatively high and looking into large scale production of the same it is pertinent to take measures to reduce the power per MT.
- This paper is mainly to discuss the measures to reduce optimum specific consumption per ton of silico manganese produced by adopting optimum mix of raw material resources.

Capacity of Ferro Alloys

Installed Capacity of Ferro Alloy as on date = 2900 MVA
Approx 2300 MWH

By Tonnage Total Capacity = 5.15 Million Tonnes

Installed Capacity for Mn Alloys = 3.16 Million Tonnes

Capacity Utilization = 55%

With change in steel melting Technology ,consumption of silico manganese increased and Ferro manganese decreased.

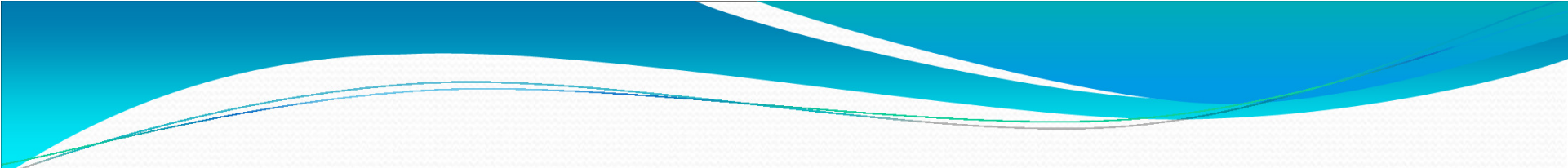
At present share of Silico Manganese Production out of total Mn alloys is about 85%.

Ferro Alloy industry continue to remain potential exporter for earning substantial foreign exchange for the country

At the same time the industry has started importing considerable Quantity of Manganese Ore lumps as well as fines which is mainly for export purposes by consuming foreign exchange.

S.No	Year	Imports
1	2008-09	8,52,200
2	2009-10	7,97,933
3	2010-11	12,99,640
4	2011-12	19,61,390
5	2012-13	23,26,729
6	2013-14	21,79,336
7	2014-15	31,72,858
8	2015-16	22,16,864

Thus the imports have increased by three fold. Most of manganese ore imported goes into the production of silico manganese to blend with domestic low grade ores with low Mn-Fe ratio.



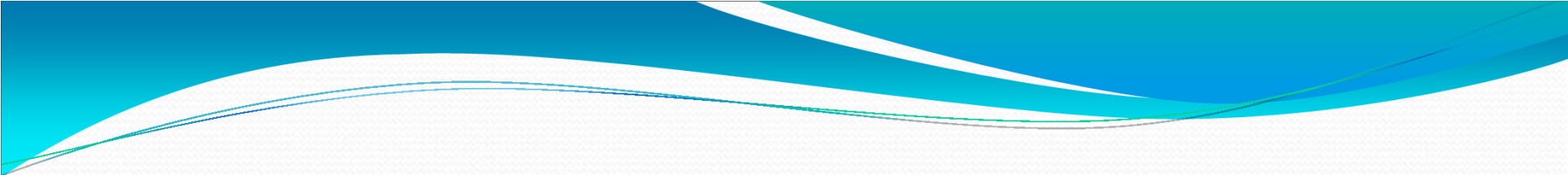
Production of manganese based alloys shifted from Fe-Mn to Si-Mn even though specific power consumption of silico Manganese is high due to the changed requirement of steel melting technology.

Specific Consumption of power for production of silico manganese varies from 3400 KWH to 4200 KWH /Ton and depends on raw material mix.

➤ Developed countries like USA, Japan, UK are not producing Ferro alloys since Ferro Alloys production is power intensive instead they import for their requirement even though power tariff is more or less comparable(0.08\$ per Kwh)

➤ In india availability of power is major concern and still we produce Ferro alloys in major quantities even by importing raw materials. Since by exports country is improving BOP, measures are not taken to control production of Ferro Alloys by Govt. But it is the responsibility of Ferro Industry to think and contribute to save power.

➤ Even 100 KWH /Ton of specific power consumption is reduced in production of Silico manganese the saving of power will meet the requirement of thousands of families in India.



Specific consumption of power for production of silico manganese is increasing on account of following reasons

A. Usage of very low grade ores.

B. Usage of Ferro manganese slag in more proportions.

C. Usage of ultra fines as it is.

A. Usage of very low grade ores

Grade wise global production of manganese ore

Country	Grade(Mn)
South Africa	30-48%
Australia	37-53%
Gabon	45-53%
Brazil	33-51%
China	20-30%
Kazakhstan	20-30%
Ukraine	30-35%
India	10-50%

In India very low grade ores are being produced and consumed as low as up to 10% Mn

1. To compensate Mn-Fe ratio and Phos content Ferro manganese slag is being used in more proportions or Blended with imported ore(lumps or fines) by which country's BOP is getting affected
2. To avoid the above it is essential to upgrade the ore by physical means before feeding into the furnace . This will reduce specific consumption of power.

B. Usage of slag in more proportions

- Si-Mn is produced from different mixes of Mn ore, Fe-Mn slag, Quartz and fluxes.
- There are significant differences in melting behaviors and reduction of Mn resources.
- Some plants use only manganese ore and other plants use Ferro Manganese slag
- Slag is used in more proportions to compensate low grade ores with low Mn-Fe ratios and to increase the resistance of the charge

B. Usage of slag in more proportions

Process of silico manganese divided into following stages

A. Heating and preproduction in solid state. At this stage (at 1100°C to 1200°C) Manganese oxides reduced to monoxide, Iron oxides reduces to metallic iron.

B. Formation of liquid slag and manganese oxide reduction.

-This stage is completed at top of coke bed. The temperature at the top of the coke bed is expected at 1550° C.

-At this stage liquid slag should have low viscosity to percolate through the coke bed.

-At this temperature low MnO in the slag is expected.

C. Reduction of silica from slag and reduction of MnO at temp of 1550°C to 1650°C.

B. Usage of slag in more proportions

If slag is used the energy consumption increases by about 500KWH/ton of slag, because of the following :

- If Mn ore only used in production of silico manganese at temperature ranging from 1300°C to 1600°C only small amount of liquid slag remain as main phase.

Where as if Fe-Mn slag is used at temperature interval 1300°C to 1600 °C , Fe-Mn slag only results in formation of molten slag which remain as main phase.

- The amount of slag Produced is much higher in case of using slag when compared to ore

- If Manganese Ore is added in place of slag, the exothermic reaction of higher oxides of Manganese to MnO takes place in to top layers of charge by which the heat produced can b e used for preheating & pre reduction of charge which is not the case with slag as raw material in more quantities.

By using Fe-Mn slag:

- Specific power consumption is increased
- Facilitates use of low grade ore but at the same time shifting equilibrium of the reaction requiring high temperature.
- Production of more slag.
- Reduced availability of furnace.

Hence efforts are to be made to limit use of slag to save energy which is the most precious in Indian condition.

C. Usage of ultra fines as it is

In the recent past even fines are imported in large proportion and being used in furnace as it is,

Because of this

- Charge porosity becomes poor.
- Formation of lead zones reducing the availability of furnace and choking of furnace.
- Charge eruptions
- Highly polluting atmosphere in and around furnace.
- High inhaling of fines or furnace fumes result into ill health of employees.

To avoid direct use of fines the same need to be sintered before used.

The advantages of sinter is

- Porous charge
- Reduction of sinter can start at low temperature when compared to ore because of different rate of MnO reduction from ore and sinter
- The difference in melting temperature of the ore and sinter is about 40°C

Hence it is recommended to use sinter only in place of fines.

CONCLUSION

In India yearly production of silico manganese in recent past is about 15-18 lakh tonnes .

As silico manganese consumes more power per ton which is major contributor in the cost of production attention is required to adopt measures for reducing specific power.

India is already facing shortfall in power and even one unit of power saved is power produced.

Hence time has come to reduce the usage of Ferro manganese slag & low grade ores and fines instead use high grade ores by adopting beneficiating techniques to upgrade low ores and sintered fines .



THANK YOU

