KAWASAKI STEEL TECHNICAL REPORT
No.6 (September 1982)

Smelting of Low-Silicon Pig Iron in Blast Furnace

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Synopsis :
On the basis of findings of Si content changes in pig iron produced in recent years at blast furnace of Chiba and Mizushima Works, the methods of smelting a low Si pig iron in blast furnace are discussed from the viewpoints of chemical reaction kinetics and liquids flow in the packed bed. Relations of blast furnace operational variable and characteristics to Si contents in pig iron are analyzed using actual data. With a possible target of Si content in pig iron in the near future proposed to be around 0.1%, the paper also discusses some problems which must be solved in attaining the target with a stable furnace operation.

The body can be viewed from the next page.

Smelting of Low-Silicon Pig Iron in Blast Furnace*

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On the basis of findings of Si content changes in pig iron produced in recent years at blast furnace of Chiba and Mizushima Works, the methods of smelting a low Si pig iron

reduction in heat loss from the furnace wall, and

P_{SiO} and P_{CO}: Partial pressure of SiO and CO, respectively

a_{Si}: Activity of Si in pig iron

Eq. (2) holds for a unit volume within the furnace. On the other hand, SiO in bosh gas is supposedly

the slag-metal reaction in the dropping zone. At present, the reduction of SiO_2 contained in coke ash to Si in pig iron via SiO is regarded as a greater factor for the determination of Si content in pig iron than the reduction of SiO_2 contained in the ore as gangue depends not only upon the height of dropping zone, but also upon the actual velocity of liquid descent. [redacted]

volumetric velocity, U_l, and total hold-up, H_l, as in eq. (6).

[redacted]

$$V_l = \frac{U_l}{H_l} \quad \cdots\cdots (6)$$

[redacted]

Since U_l is the volume of liquid passing through [redacted]

cases, its contribution to H_S should be taken into consideration.

[redacted]

affected by U_M and U_S, respectively, but retention time is largely affected by U_M and U_S, respectively [redacted]

as it turns short inversely proportional to the increase in U_M and U_S because of the correlation indicated in [redacted]

If the particle size of coke in the dropping zone is [redacted]

[redacted]

contact of SiO_2 in slag with coke, A_{SC} represents the of $D_P^{-0.7}$ and $U_S^{0.4}$, respectively. The correlation of

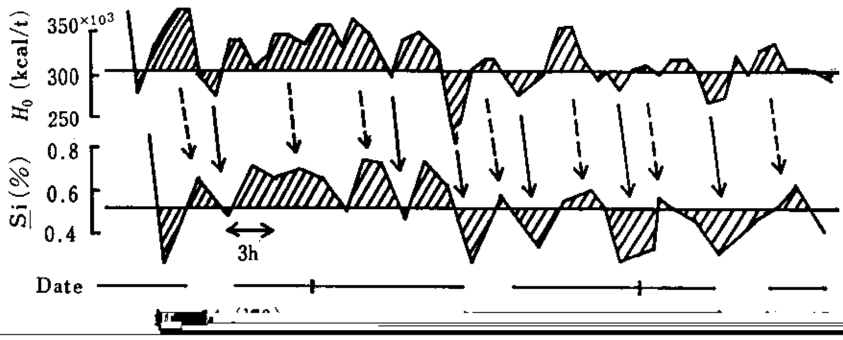
[redacted]

and materials balance in the blast furnace from

4 Features of Blast Furnace Operation vs. Si Content in Pig Iron

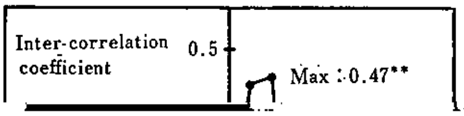
4.1 Short-time Relationship

moment to moment. **Fig. 5** shows changes in time of H_0 and Si content, and **Fig. 6** changes in the correlation coefficient with respect to delayed time between H_0 and Si. **Figs. 5** and **6** show that the Si content at



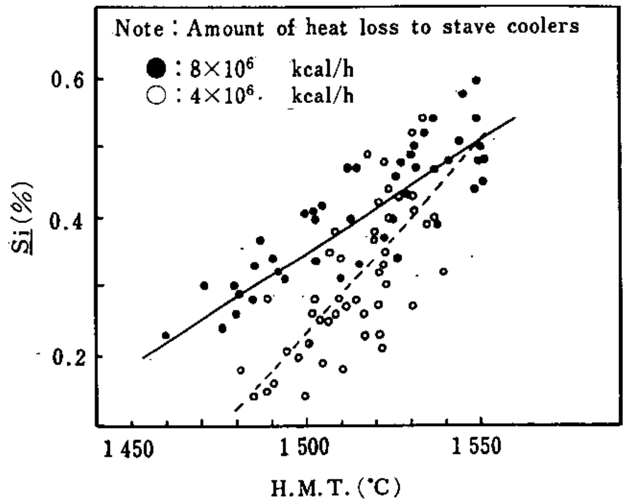
[redacted]

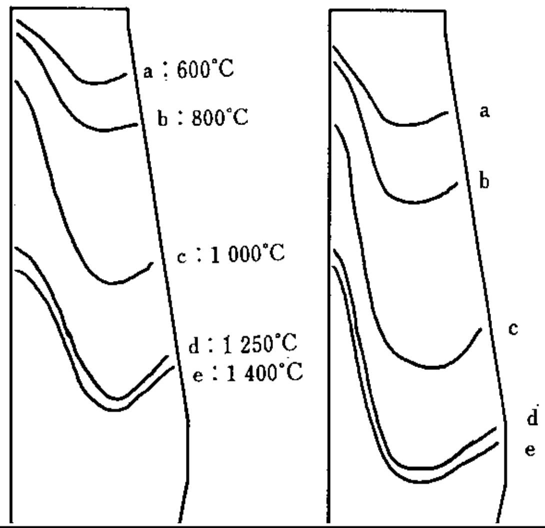
Fig. 5 An example of variation of H_0 and Si content with time (Chiba No. 6 BF)



4.2 Long-time Relationship

[redacted]


Note : Amount of heat loss to stave coolers
● : 8×10^6 kcal/h
○ : 4×10^6 kcal/h
0.6
0.4
0.2
Si (%)
1 450
1 500
1 550
H.M.T. (°C)


a : 600°C
b : 800°C
c : 1 000°C
d : 1 250°C
e : 1 400°C
a
b
c
d
e

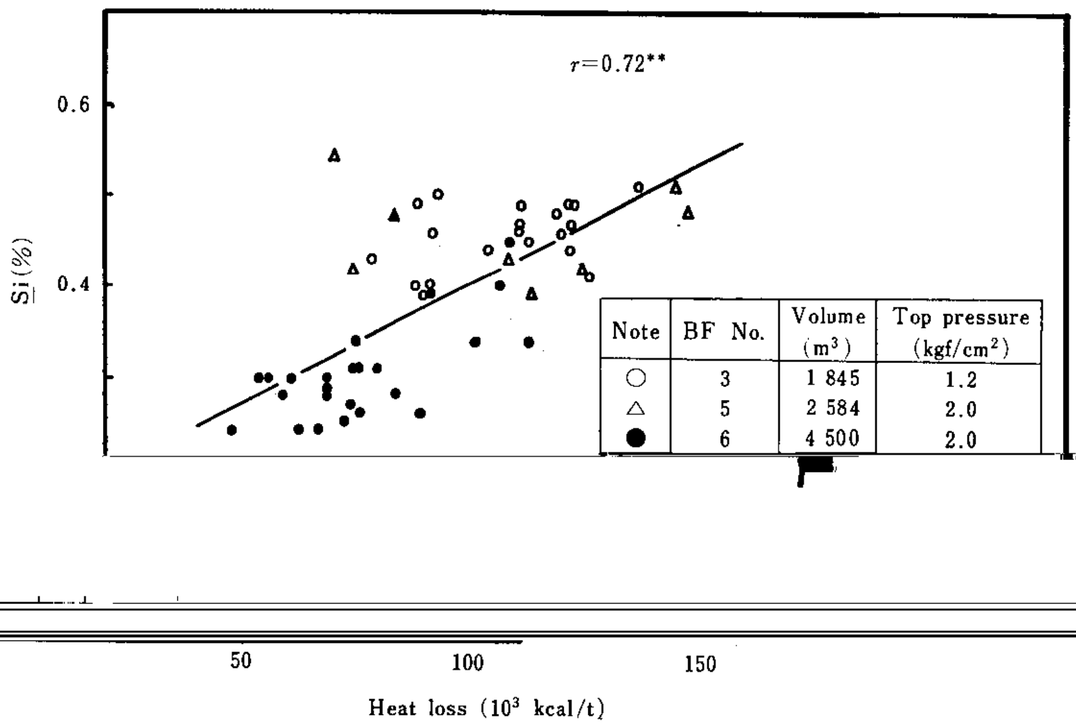


Fig. 12 Influence of heat loss from high temperature region above 950°C on Si content in pig iron (Chiba Works)

lated on the basis of heat balance in the 10-day average

$$k_f = 4.77 \times 10^8 \exp\left(\frac{-66\,500}{RT}\right) \quad \cdots\cdots(16)$$

and controlling the temperature of coke in the dropping zone while maintaining the currently available

challenged, aiming at a hot metal temperature of

[illegible] 10) N. T[illegible] S. T[illegible] 11) S. Takata and K. Okabe: "D[illegible]