KAWASAKI STEEL TECHNICAL REPORT

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*Special Issue on Stainless Steels*

# Progress in Stainless Steel Production by Top and Bottom Blown Converter

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Synopsis :

Taking the chance of stainless steelmaking integration at Chiba Works in April 1981, an 85 t new UHP melting furnace (MF) was erected and existing LD converters were converted into top and bottom blown converters as Chiba No.1 steelmaking shop for rationalization of the stainless steelmaking process. Saving energy by replacing electric power with coke and enlarging flexibility in material choices were considered to be the basic concept of cost reduction. To achieve this objective, hot metal dephosphorization, and inexpensive heat compensation system and high speed refining process using the top lance were developed. As a result, optimization of the stainless steel making process and hence cost reduction were achieved.



The body can be viewed from the next page.

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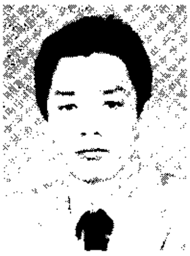
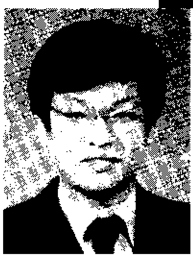





*Synopsis:*

*Taking the chance of stainless steelmaking integration at Chiba Works in April 1981, an 85 t new UHP melting furnace (MF) was erected and existing LD converters were converted into top and bottom blown converters at Chiba No. 1 steelmaking shop for rationalization of the stainless steelmaking process.*

## 2 Features of Stainless Steel Refining Process and Equipment Specifications

### 2.1 Features of Stainless Steel Refining Process

Because raw material costs account for the greatest part of total manufacturing costs for stainless steel, the

These production conditions include control of the oxygen flow rate of the top lance in the K-BOP converter, by which both a shortening of decurburization time and promotion of sulfur vaporization are realized, and, in addition, CaO powder injection during the reduction period, which achieves the object of improving desulfurization capacity during reduction.

very important from the viewpoint of cost reduction

stainless steel by K-BOP may be summarized in the folthese techniques, it has become possible, in the manufacture of stainless steel at Chiba Works, to select the optimum refining process to meet changes in circum-

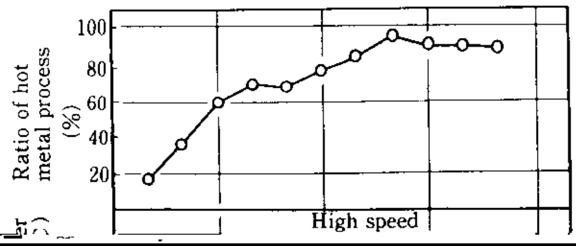
torpedo car, blowing through a slanted lance is used, with a limebased dephosphorizer blown in at a rate of 450 kg/min

The refining process for stainless steel is shown in Fig

diluted-gas, equivalent to AOD, by mixing an inert gas

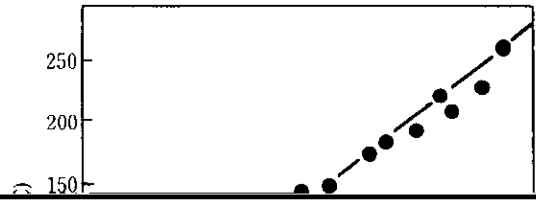
Table 2 Changes in chemical compositions and temperature during hot metal treatment

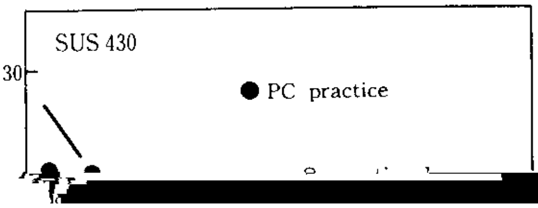
| | Chemical composition (%) | | | | | Temp. (°C) |
|---|---|---|---|---|---|---|
| | C | Si | Mn | P | S | |
| Tapping from BF | 4.50 | 0.25 | 0.30 | 0.140 | 0.035 | 1 480 |

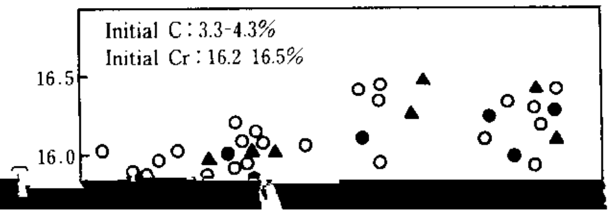


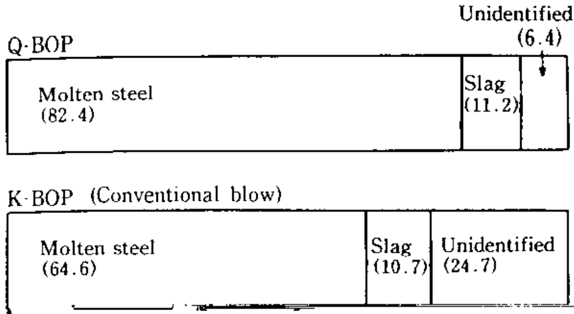
### 3.2.1 Heat compensation system by top-addition of coke

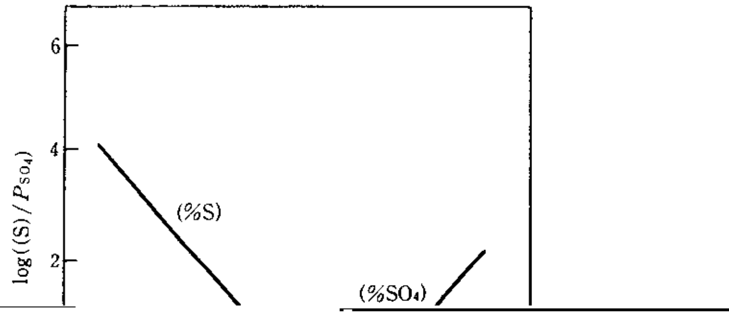
The technique of using coke as a heat source has the following advantages over the FeSi method, which is widely used as a heat source:




SUS 430
30
PC practice


Initial C : 3.3-4.3%
Initial Cr : 16.2 16.5%
16.5
16.0


Q-BOP
Molten steel
(82.4)
Slag
(11.2)
Unidentified
(6.4)
K-BOP (Conventional blow)
Molten steel
(64.6)
Slag
(10.7)
Unidentified
(24.7)


6
4
2
log((S)/$P_{SO_4}$)
(%S)
(%SO₄)

$[\%Mn]_{HM}$: Mn in hot metal

carbon zone immediately after the start of blowing, it is difficult to control [%C] in the steel bath; when Mn ore is added in the high-temperature, low-carbon zone near the end of blowing, it is difficult to control the steel bath temperature. For the optimum period for adding Mn

$$-\frac{d\{(W_S/\rho_S)(\%Cr_2O_3)\}}{dt} = k_P^S \cdot a_P\{(\%Cr_2O_3) - (\%Cr_2O_3)_{equiv.}\} \cdots\cdots (5)$$

$$\frac{d[\%S]}{} = k_T^m \cdot a_T [\%S] + k_P^m \cdot a_P \{[\%S] - (\%S) \ldots (6)$$

Figure 21 shows the relation between the timing of is results. This is considered to be caused by the promotion of desulfurization and slag formation by the floating action of the lime powder. Further, by putting into practice the reduction period F/I, the amount of the CaO, not formed into slag is decreased and unit consump-

## References


1) T. Ohtani, M. Shibata, R. Asaho, S. Hamada, G. Yaji, Y. Kato: *Kawasaki Steel Technical Report*, 8(1983), 47
2) K. Taoka, T. Ohtani, T. Imai, R. Asaho, M. Hirose: *Tetsu-to-Hagané*, **68**(1982)11, S 1032