KAWASAKI STEEL TECHNICAL REPORT
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Production of Stainless Steel by Top-and-Bottom-Blown Converter

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Synopsis :
At Chiba Works, an 80 t new UHP melting furnace (MF) was erected and the existing LD converter was converted into a top-and-bottom-blown converter (K-BOP) at its No.1 Steelmaking Shop. This was in line with a stainless steelmaking integration program modified from the former setup involving two steel works of Nishinomiya and Chiba. An entirely new process came on stream in March 1981 for the bilateral production of carbon steel and stainless steel by K-BOP and MF - K-BOP. Furthermore, equipment for hot metal treatment was installed to supply dephosphorized hot metal instead of iron scrap in MF practice. Owing to this change, a significant increase in productivity and cost reduction were achieved. Studies on the reaction model and standardization

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by Top and Bottom Blown Converter*

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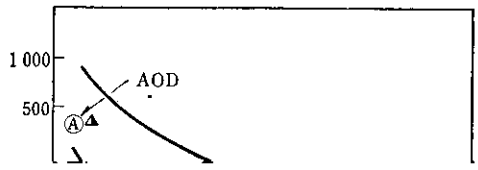
Table 1 Specifications of ME and auxiliary equipment

(3) This vessel is advantageous in desulfurization

because lime powder injection is possible



the blowing time of the K-BOP vessel, an investigation was made under the operating conditions shown in **Table 2** and it was found that refining can be completed in about 80 minutes even at 1 $Nm^3/min \cdot t$. Moreover, the decarburization time can be shortened if the

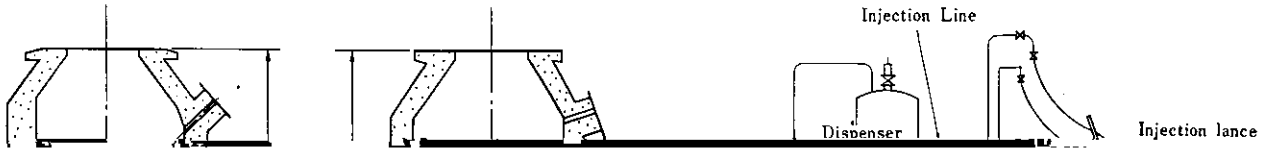

Injection Line
Dispenser
Injection lance

Table 6 Noise reduction by clean house (C.H.)

Inside of C.H.	Outside of C.H.
Boring period Max.125 dB	Vicinity of C.H.*80~85 dB
Melting period 100~119 dB	Pulpit 67~76 dB

* 1 m apart from C.H. wall

prevent electrode breakage, low-power-factor operation is carried out in the ignition period and boring period and the arc is thus kept stable. In the main melting period, the operation time is shortened by

60 minutes by using the oxygen blowing lance.

3.3 Operation Results of K-BOP

3.3.1 Top-and-bottom-blown process and behavior of molten steel composition

Figure 9 shows the operation pattern for type 304 stainless steel and an example of behavior of molten steel composition. After the start of blowing,

the decarburization rate are very high. **Figure 11** shows a comparison of the time required for decarburization refining. The oxygen supply rate can be increased in the K-BOP process and, hence, this time is about 10 to 25 minutes shorter than in the bottom-blown process.

K-BOP process has very high productivity and that the tap-to-tap time can be shortened from conventional 70–80 minutes to 45–60 minutes.

3.3.2 Establishment of nontilting practice

The K-BOP vessels at Chiba Works are provided

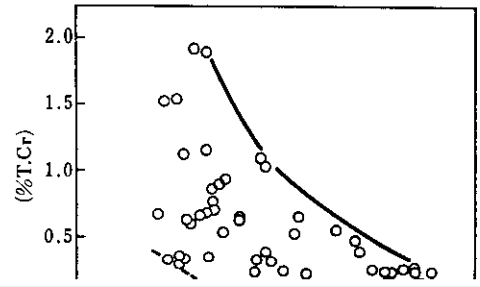
From the above, it was found that the refining process for stainless steel in the high carbon range by the

with sublance equipment. **Figure 12** shows a comparison of the operation pattern for stainless steel production between the conventional practice and the nontilting practice using the sublance. Sublances have been positively used since the start-up of these

4 Slag Composition during Stainless Steel Refining

4.1 Oxide of Chromium and Desulfurization Behavior in Reduction Period

Figure 13 shows the relationship between (%T.Cr) of slag after reduction refining and the actual basicity (%CaO)/(%SiO_2). The higher the actual basicity, the larger the amount of chromium recovered in the



(%SiO_2) $\geq$ 1.6. The following equation is valid if the reduction rate of Cr_2O_3 is mass-transfer controlled in terms of the Cr_2O_3 in slag:

0.8 1.0 1.2 1.4 1.6 1.8 2.0
(%CaO)/(%SiO_2)

Fig. 13 Relation between (%T. Cr) in slag and

2.4 [redacted]

refined by the K-BOP process and, at the same time, slag were considered to ensure stable operation.

K-BOP was established. In addition, hot metal treatment equipment was installed. A substantial decrease in the operation time and cost reduction

References

1) R. Uchimura et al.: *Kawasaki Steel Giho*, **15** (1983) 2, p. 45