KAWASAKI STEEL TECHNICAL REPORT
No.32 (March 1995)
Ironmaking Technology, Secondary Refining,
and Center-Segregation Control with Forging in CC

Improvement of Properties of Rods and Bars by Continuous Forging Process

Masanobu Kawaberi, Yoshiji Yamamoto, Kazuo Asoh

Synopsis :
Kawasaki Steel has developed a continuous forging process capable of producing rods and bars with neither center segregation nor ce nter porocities. This method also makes it possible to control the center segregation ratio less than 1.0. The application of this method has improved a rolling-contact fatigue life of bearing steel, and has annihilated inner porocities of big size diameter bars made from continuously cast bloom. By utilizing the negative segregation obtained by this method, the carbon steel bars for machine structural use can be easily drilled at center portion due to a decrease in hardness. The alloy steel rods for machine st ructural use also can be drawn at high

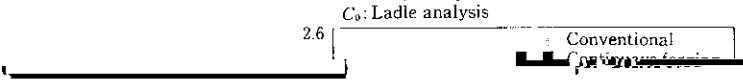
Improvement of Properties of Rods and Bars by

Synopsis:

Kawasaki Steel has developed a continuous forging

[redacted]

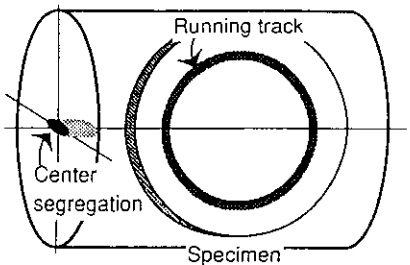
C: Check analysis of bloom (5 mmϕ drill)
C_0: Ladle analysis

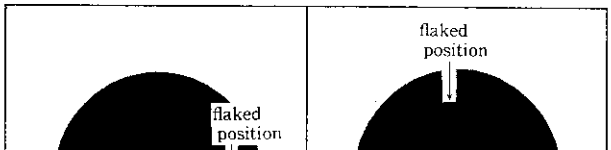


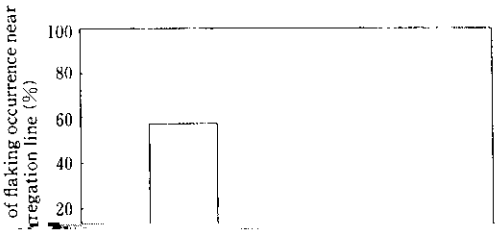
steel for ball use of bearing [illegible] life test

Steel grade	C	Si	Mn	P	S	Cr
JIS SUJ2	0.99	0.26	0.40	0.017	0.003	1.34

Item	Value
Size of contacting ball	9.525 mmϕ
Hertz maximum contact stress	5 260 N/mm^2
Rotating speed	1 800 cpm
Lubricatig oil	#68 Turbine oil






of flaking occurrence near
tregation line (%)
100
80
60
40
20

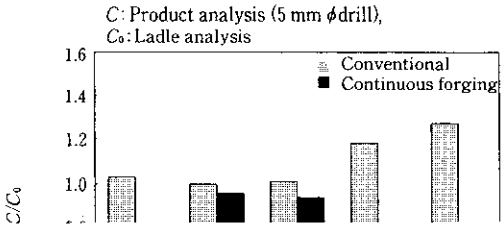

C: Product analysis (5 mm ϕ drill),
C0: Ladle analysis
Conventional
Continuous forging
C/C0
1.6
1.4
1.2
1.0

Figure 8 shows the results of a drilling test. Tool life was evaluated by the total length drilled until drilling

tomer to omit the annealing process, but when the

than with the conventional material.

3.4 Increased Ductility in High Carbon Steel Rods

Both strength and ductility are required in final products produced by drawing high carbon steel rods. C

treatment processes with continuously forged products.

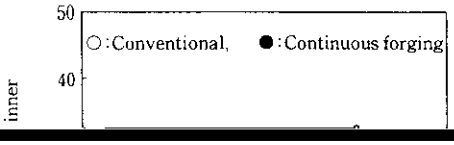
3.5 Higher Strength Obtained by Adoption of Higher Carbon Contents

[redacted]

ventional rods with centerline segregation [redacted]

3.6 Continuous Casting of Large Diameter Round Bar

The solidification and contraction of billets causes po-



4 Conclusions

As described above, the continuous forging process not only improves the quality of rod and bar products, but also makes it possible to improve the productivity of