

KAWASAKI STEEL TECHNICAL REPORT

No.25 (September 1991)

*Special Issue on 'H-Shapes with
Fixed Outer Dimension' and 'Steel Pipe'*

Weld Zone Toughness of ERW Ti-Stabilized 11 % Cr Steel Pipe for Automobile Exhaust Systems

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Synopsis :

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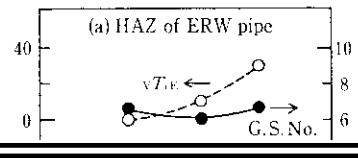
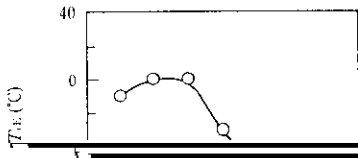


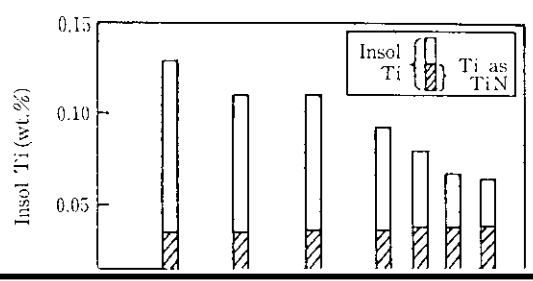
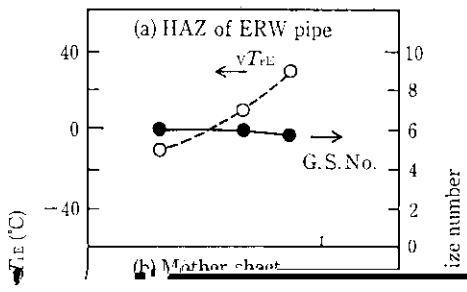
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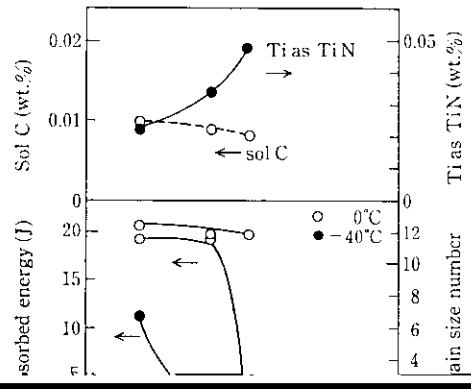
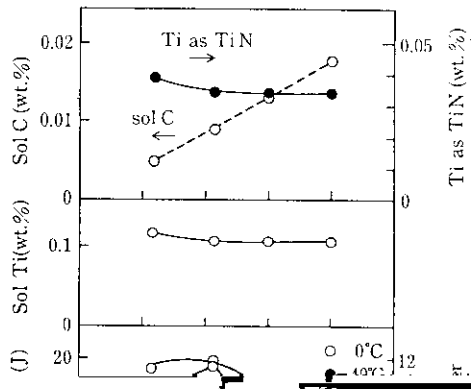
The toughness of weld zone of ERW Ti-Stabilized 11% Cr steel pipe produced by a "chance-free" bulge roll (CRB) forming pilot mill was investigated. The weld zone, particularly HAZ, had its toughness markedly lower than in the base metal. The reason for this embrittlement was examined by investigating gas absorption behavior of Ti and C.

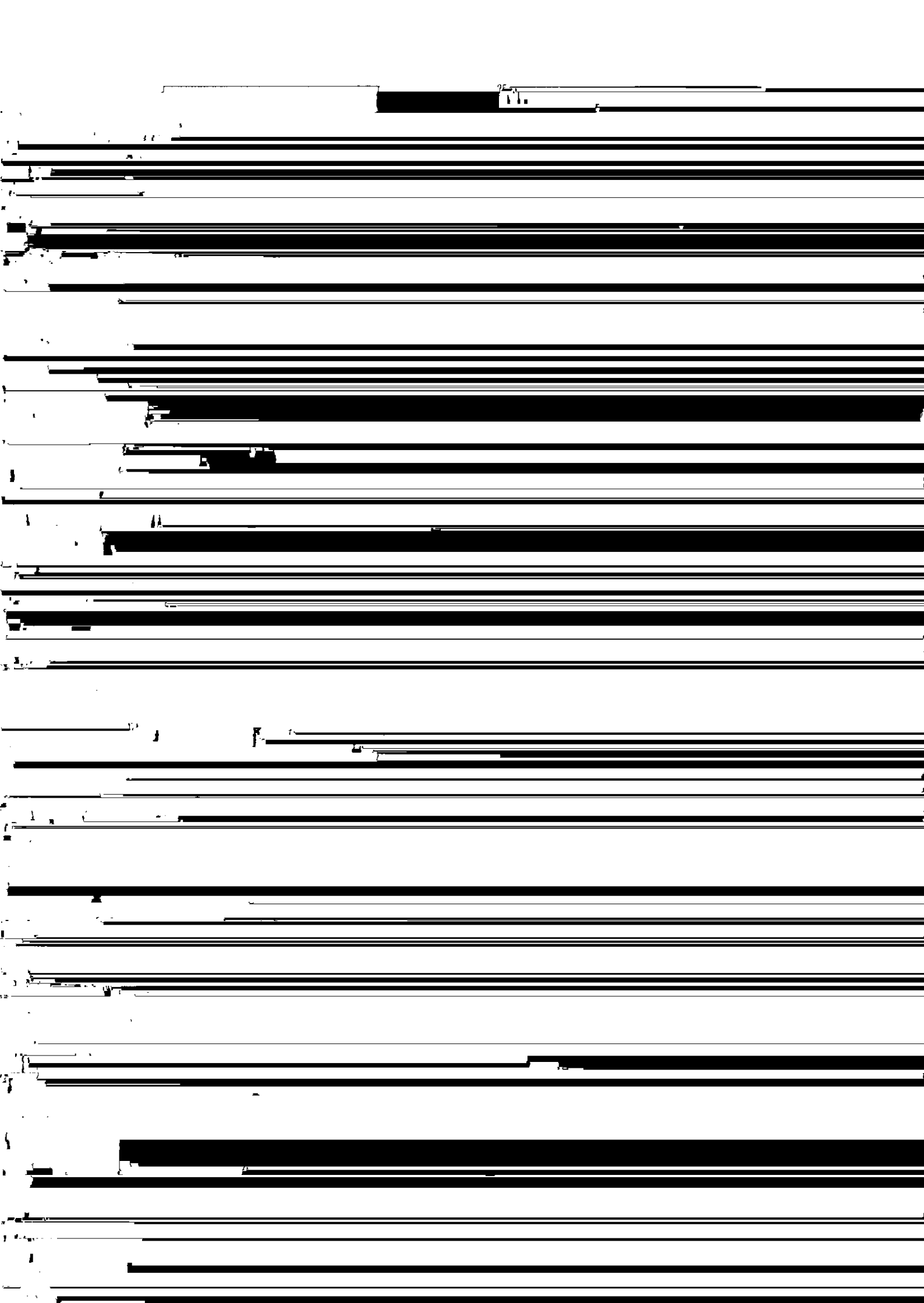
2 Experimental Method

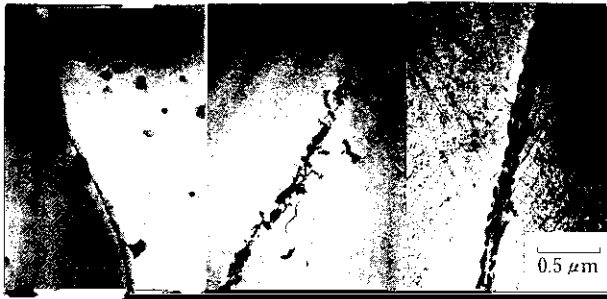
cross-cut method (JIS G-0052). The precipitates were determined by observing thin films and carbon extrac-











1250°C. Therefore, an examination was made to determine whether the precipitation of carbide would be possible in such a short time.

The theoretical calculation by Arai et al.¹⁴⁾ is well known for analyses related to the precipitation of chromium carbide in ferritic stainless steels,¹¹⁻¹⁵⁾ and Tomimura et al.¹⁵⁾ have conducted analyses by converting this theoretical expression into an approximated expression. In this report also, the precipitation of

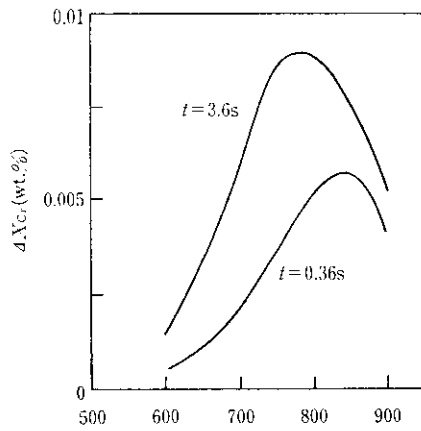
(a) As annealed

(b) After water
quenched from
1250°C

(c) After aged
at 700°C for 30s

expression.

Since precipitation was concentrated at the grain



Reheating temperature (°C)

Fig. 11 Relation between calculated Cr content as Cr_{23}C_6 precipitate, $\Delta X'_{\text{Cr}}$, and reheating temperatures (0.01C-11Cr)

results obtained are as follows:

- (1) The toughness of ERW pipe weld zone was lower than that of the base metal, the HAZ showing low values in particular.
- (2) The reason for the HAZ having low toughness values is thought to have been that TiC was dissolved by heating to high temperatures, solute carbon being precipitated as chromium carbide in the cooling process, and that supersaturated carbon was present due to quenching.
- (3) TiN lowered the toughness in both the HAZ and the base metal.
- (4) Toughness in the HAZ was improved by reducing the carbon and nitrogen contents.

References

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- 2) S. Yamamoto, Y. Kobayashi, M. Katahira, T. Takano, M. Takeshita, and T. Nagamine: *Nippon Kokan Technical Report*, 120(1988), 7
- 3) H. Sakurai and T. Ogawa: Preprints of the national meeting of J.W.S., 45(1989), 280
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ture and the longer the reheating time, the more X'_{Cr} would approach X_{Cr}^0 , with the result that the value of $\Delta X'_C$ decreases. Therefore, the amount of precipitation