

# HIC and SSCC Resistance in High Strength Line Pipe Steel Processed by Interrupted Accelerated Cooling

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## 1. Introduction

Modern steel plate processing techniques involving controlled rolling into the ferrite plus austenite field and, more recently, the development of interrupted accelerated cooling after rolling, made it possible to simultaneously reduce the alloy content of line pipe steels while maintaining a superior strength-toughness balance. In this study the effect of accelerated cooling after controlled rolling on the HIC and SSCC resistance is investigated in high strength line pipe steels.

## 2. Experimental Method

Table 1. Chemical compositions of line pipe steels (wt.%)

Several laboratory heats were induction melted for the line pipe steels of

C	Mn	Si	P	S	Sol. Al	Nb, V, Mo, Ti, added
0.08	1.60	0.27	0.012	0.005	0.05	

this study, as shown Table 1. HIC test and SSCC test were carried out in accordance with the NACE standard TM02-84 and TM 01-77. Microstructures of the accelerated cooled steel and air cooled steel were observed by scanning electron microscope.

## 3. Results and discussion

(1) The interrupted accelerated cooling process improves the resistance to hydrogen induced cracking by promoting random nucleation of ferrite during transformation and thereby eliminating banded microstructures.

Table 2. Summary of comparison of HIC and SSCC results between I.A.C and air cooling

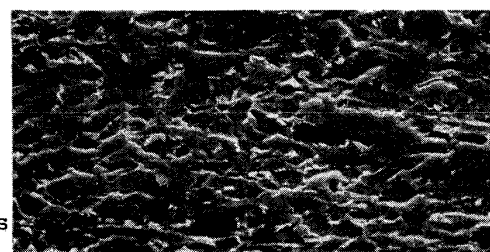
Process	HIC Evaluation		SSCC Evaluation
	Ultrasonic Method (CAR)	Metallographic Method (CLR)	Threshold stress (% of Yield strength)
I.A.C	9.9	17.2	82
Air cooling	57.6	96	79

(2) The resistance to sulfide stress corrosion cracking is not affected significantly by the above process

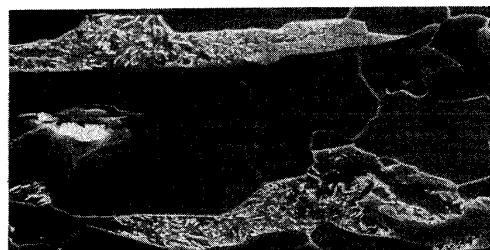
(3) It was observed that sulfide stress corrosion cracks were sometimes initiated at the tip of hydrogen induced cracks, but the results of the sulfide stress corrosion cracking tests did not coincide with the results of the hydrogen induced cracking tests.

## 4. References

- (1) A.P. Coldren, AMAX Report L-176-243 (1983)
- (2) H. Tamehiro, et al, Seitetsu Kenkyu No. 316 (1984) P. 26



(a) I.A.C X2000



(b) Air cooling X2000

Fig. 1. SEM microstructures of I.A.C and air cooled steel.