Abridged version

KAWASAKI STEEL TECHNICAL REPORT No.20 (June 1989)

Information Systems

High Strength 2-1/4 and 3% Cr-1% Mo Steels with Excellent Hydrogen Attack Resistance

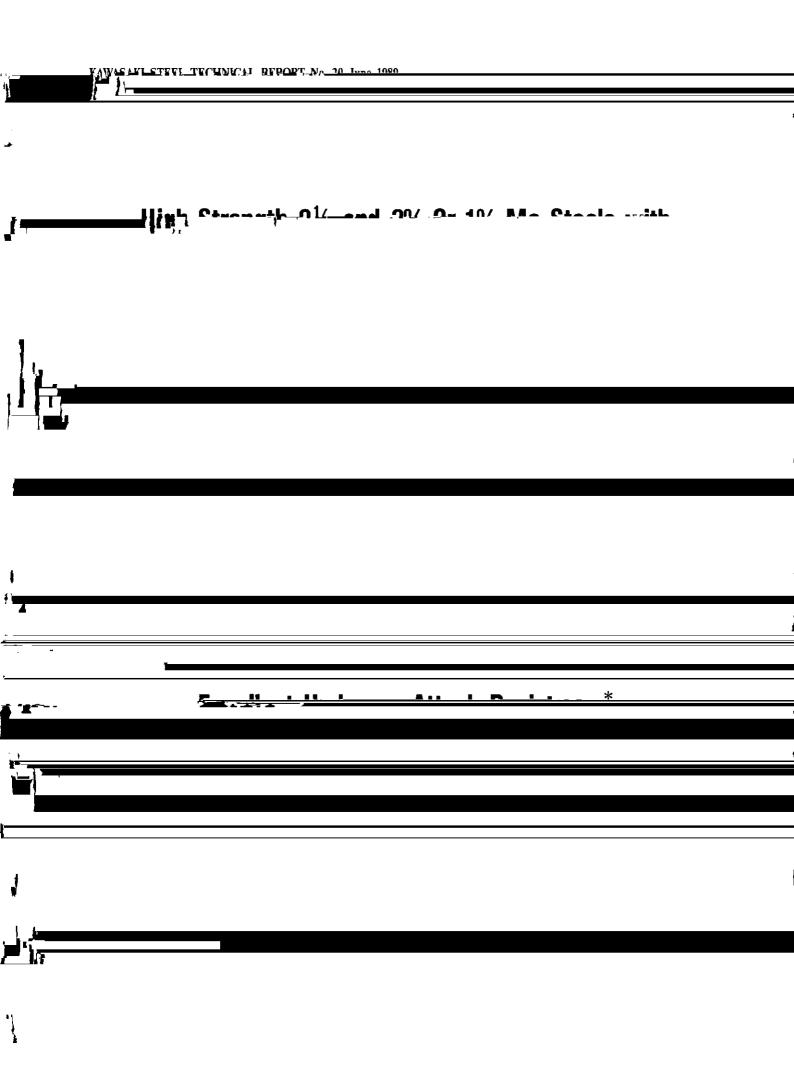
Jun-ichi Shimomura, Hidefumi Tani, Takeshi Kooriyama, Shingo Sato, Syuzo Ueda

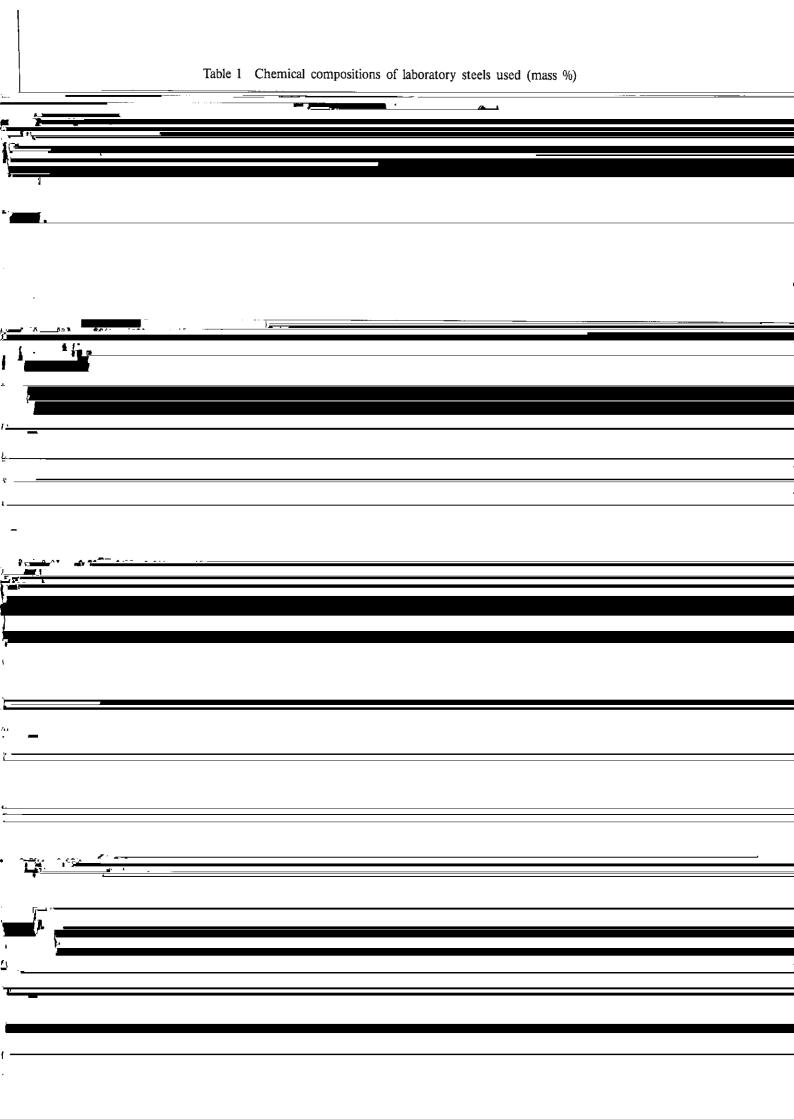
Synopsis :

To develop 300-mm thick alloy-modified 2-1/4 Cr-1 Mo steels for pressure vessels to be operated at 900°F and a hydrogen pressure of 3 ksi, laboratory study and factory-scale production trial were carried out. The main results obtained follow: (1) The addition of 0.25 0.30%V, 0.015 0.020 Nb and a small amount of B, and the reduction of Si content to less than 0.1% realizes the modified 2-1/4 Cr-1 Mo Steel. The steel satisfies the target values of strength and toughness as proposed by MPC and API after PWHT whose tempering parameter is 20.6×103, and also gives good resistivity to hydrogen attack. (2) The addition of 0.20%V and 0.020% Nb and the reduction of Si to less than 0.1% improve creep rupture strength and resistivity to hydrogen attack of the 3 Cr-1 Mp stress, though both properties are inferior to the modified 2-1/4 Cr-1 Mo Steel. (3) These modified Cr-Mo steels give low susceptibility to reheat cracking during PWHT and good properties of narrow gapped SAW joints.

(c)JFE Steel Corporation, 2003

The body can be viewed from the next page.



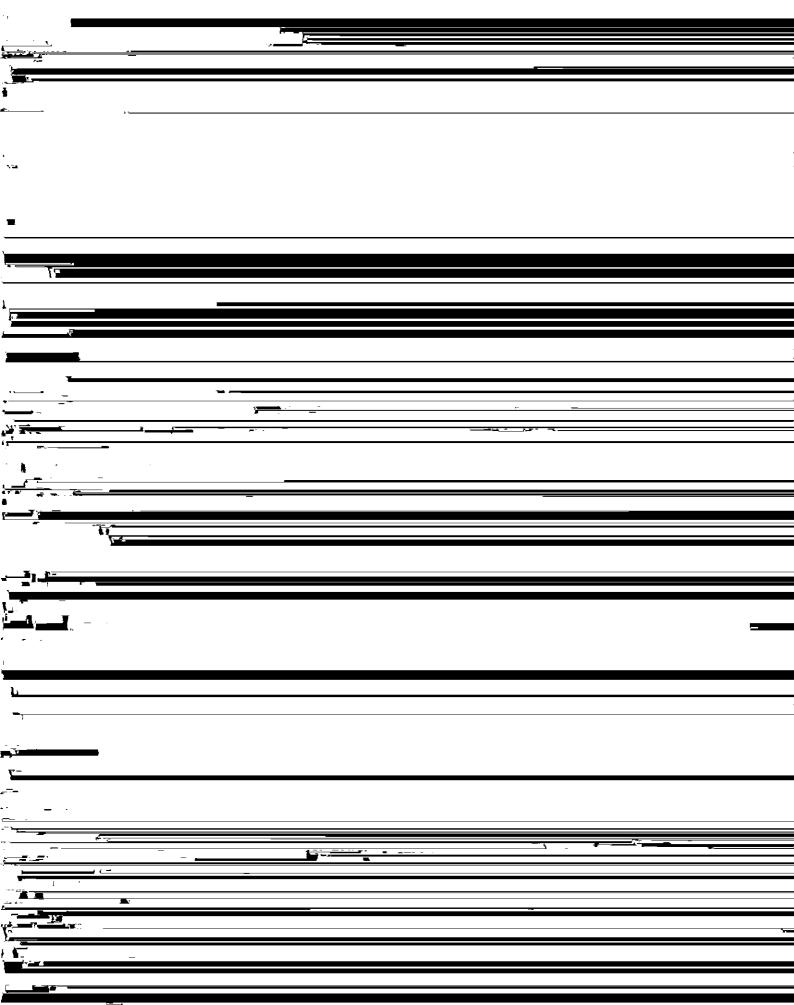


2.2 Experimental Methods

2.2.1 Fundamental experiments



Submerged-arc weld bead Base plate and test specimens after welding



	(°F)	(h)
L		·
	1	
	-	
) ···	<u>هج، ر ر ر</u>	
Jure 2		
1		
f i		
<u></u>		
* <u>***</u>		
•		
),p		
	}	
, twn 1 -	}	
1		
•		
i i		
·		
U		
کــــــــــــــــــــــــــــــــــــ		
1		
		-

	30	hond together, showing smooth grain-boundary fracture	
-			
- Alexandre and Alexandre	1		
`			
	7		
) <u>.</u>			
	e		
<u>.</u>			
• • • • • • • • • • • • • • • • • • •			_
ж.			
7			
· · · · · · · · · · · · · · · · · · ·	_		
8	/		
· · · · · · · · · · · · · · · · · · ·			
1987	×		_

ture	٨f	$M_{2}C$	tvne	and	form	precinitation-free	70065

· -

combination of a reduction in impurity alamonta and

\ <u></u>	
*	
L	
▶ <u></u>	
8	
• •	
4	
a.	
•	
₹	
¥	
¥	

	x_9	
<u></u>		
gaertron		
۲ -		
ус. с. <u>с.</u>		
۱-		
J		
·*		
t in		
·		
,		
ا <u>ر</u>		

,		(h)	
	•		
<u>.</u>			
•			
, B			
)			
<u>`</u>	· · · ·		
·			
· _			
,			
· · · · · · · · · · · · · · · · · · ·			
o	a ⁻		
7	- · · · · · · · · · · · · · · · · · · ·		
,	- -		
	ι		
	ι		
	ι		
	ι		
	ر 		
	ر 		
	ر 		

	Total Chamical compositions of wald metals.		
,)			
) 19371			
<u> </u>			
·			
↓			
•			
		T	
. —			
-			
2.			
<u> -</u> #			
ř			
	,		
- T			
1			
(
i			
	_		
4			

10 ¹ Test temp.: 482°C (900°F) Strain rate:	$\begin{array}{c c} PWHT & \epsilon_{iR} & \epsilon_{eR} & \epsilon_{eR} \\ \hline 650^{\circ}C, 16 h & O & \Box & \Delta \\ \hline 690^{\circ}C, 24.5 h & \bullet & \bullet & \bullet \end{array}$	(°F -100 0 100 = 350	$\frac{200}{1}$ $\sqrt{\frac{500}{1}}$ $\frac{600}{1}$	
	_			
	§			
u ₹				
ана на				
* <u>*</u> ,				
×				
د. د. 				
#*:				
′ ۲				
۰. ۲ <u></u>				
2				