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## Fatigue Properties of Duplex Stainless Steel SAF2507 Under Air and Corrosive Environments

( , 730050)

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L 2 : SAF2507 3. 5 % NaCl , SAF2507  
。 : , SAF2507 3. 5 % NaCl  
90 %。 , ;

2 p N: ; ;

\$% : 10. 11868/j. issn. 1001-4381. 2015. 01. 014

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&' (\*, ) : Rotating bending fatigue tests were conducted on the super duplex stainless steel of SAF 2507 to investigate fatigue properties in both air and 3. 5 % NaCl aqueous environment. The results show that on the macro scale, compared to the air fatigue, there is no significant reduction in the fatigue strength of SAF2507 under corrosive environment, which is 90 % of the air fatigue strength. But on the micro scale, the fatigue failure exhibits ductile fracture with fatigue striations observed in both ferrite and austenite in air. While in 3. 5 % NaCl, austenites have ductile fracture and ferrites exhibit cleavage fracture mode. The width and space between fatigues striations vary with grain orientations and second cracks, indicating that ferrite and austenite phase on fracture surface could not be identified simply by fatigue striations space.

- . / 0 % \$ ( : duplex stainless steel; corrosion fatigue; fatigue striation; ductile fracture

SAF2507

Calliari [4]

$\chi$   $\sigma$

, Alvarez-armas

SEM, EBSD

[5, 6] Balbi

[7]

[8]

SAF2507

$R = -1$ ,

$10^7$

3. 5 % NaCl

920 °C ,  $\sigma$

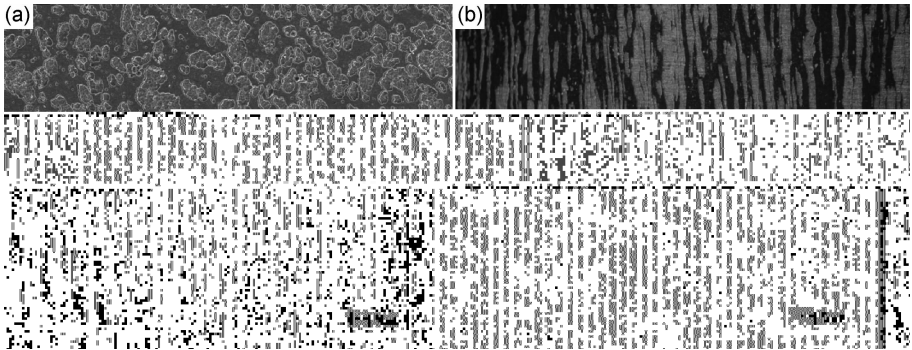
,  $\sigma$

。 , 65% ( , ) , , 35%。 : 1 M œ Ñ [ F 953MPa, 569MPa, 74%, 27.87%。

SAF2507  
(00Cr25Ni7Mo4N), 1 。 , 1 , 1(a) , 1(b) 。

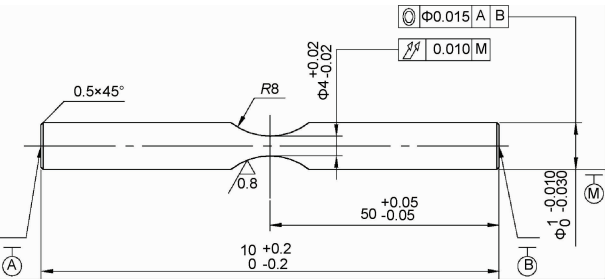
$$W_1 \quad I \quad \# \quad \tilde{A} \quad \tilde{N} \quad \tilde{I} \quad t \quad ( \hat{E} \quad t \cdot / 6 )$$

Table 1 The chemical composition of sample (mass fraction/%)							
C	Cr	Ni	Mo	N	Mn	Cu	Fe
0.03	25.00	7.00	4.00	0.25	1.20	0.50	Bal



1 SAF2507 (a) ;(b)  
Fig.1 Microstructure of SAF2507 stainless steel (a)transverse section;(b)longitudinal section

2 。 580MPa, 90%。 3.5% (  $f = 20 \sim$  NaCl , SAF2507 52.5Hz,  $R = -1$  )。 3.5% NaCl。 10%。 SAF2507 , , 0.8 ~ 1.0mL/min , , (15~20drops/min)。

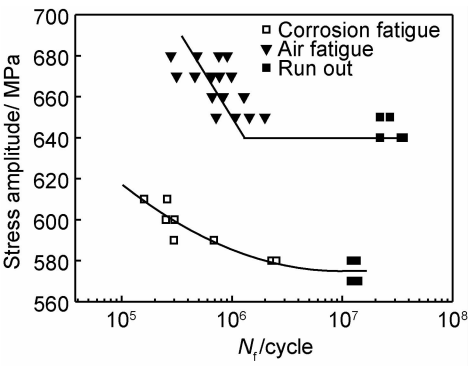


2  
Fig.2 The dimension of specimen for rotating bending fatigue test

2 M <sup>3</sup> U Ñ \* f

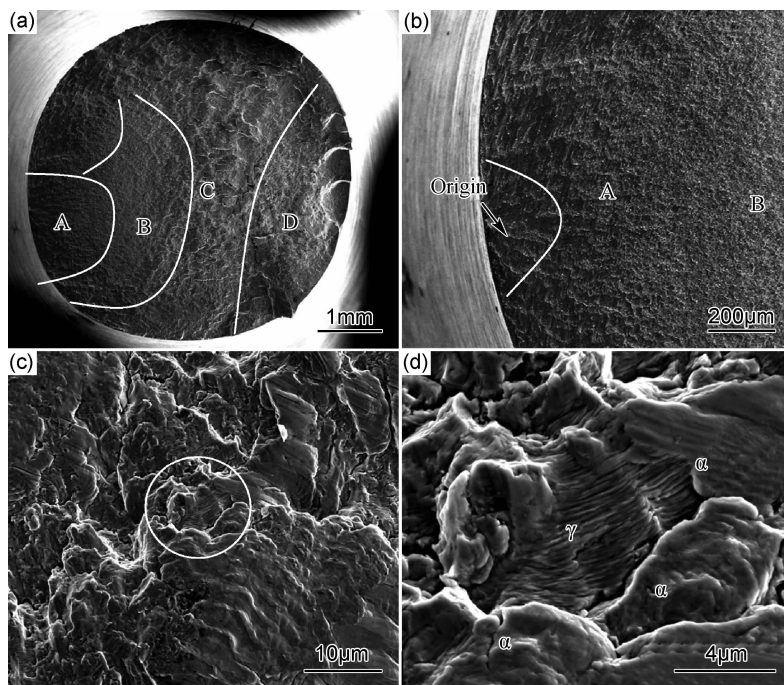
23 AN x M

SAF2507 S-N 3 。 10<sup>7</sup>。 [9] 640MPa, 67%。 3.5% NaCl , 23 c í ã 0 : Ñ <sup>1</sup> h , <sup>TM</sup> 4 。 4(a)



3 SAF2507 S-N  
Fig.3 The S-N curves in air and corrosive environments for duplex stainless steel SAF2507

。 A 4(d)  
 ( 4(b)), (γ),  
 。 B , (α)。  
 。 C 。  
 , C 6.8,  
 , 4(c) 。 4.2。



4 ( $\sigma_a = 650\text{MPa}$ ,  $N_f = 1.44 \times 10^6$  cycles)  
 (a) ; (b) ; (c) C ; (d) C

Fig. 4 The fatigue fracture morphology in air ( $\sigma_a = 650\text{MPa}$ ,  $N_f = 1.44 \times 10^6$  cycles) (a) the whole fracture appearance; (b) magnification of fatigue origin; (c) magnification of region C; (d) magnification of marked region in region C

680MPa

B

40%, 5(a)

SAF2507

5(b)

α

γ

C

5(c)

α<sub>2</sub>

α<sub>3</sub>

α<sub>2b</sub>

23

« L í ã o ! Ñ 1

, TM

α<sub>3b</sub>

α<sub>1</sub>

$d_1 \sim d_6$

C

6(a)

6(b)

EN X6CrNiMoCu 25-6<sup>[11,12]</sup>

46%,

54%)

Zeron 100<sup>[13]</sup>

6(b)

γ<sub>1</sub>

γ<sub>2</sub>

40%,

60%)

γ<sub>3</sub>

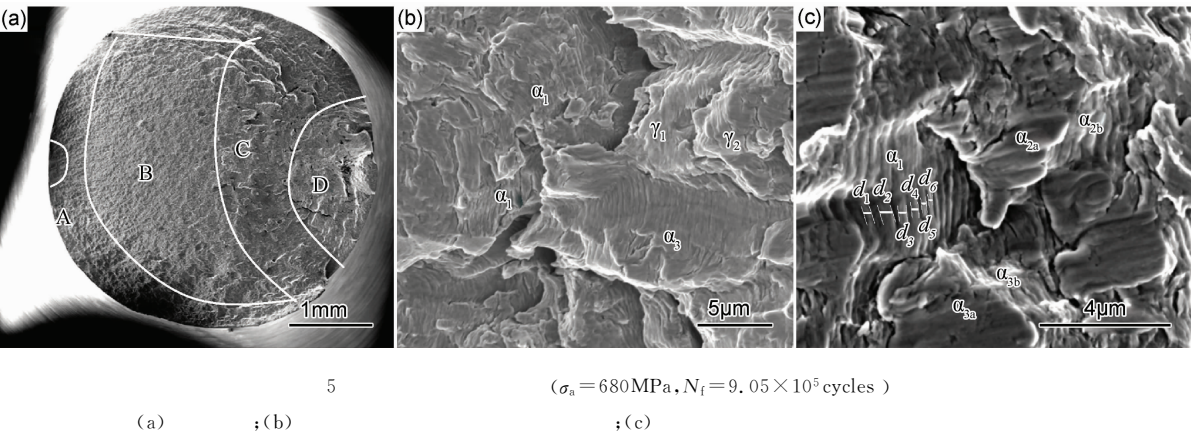


Fig. 5 The fatigue fracture morphology in air( $\sigma_a=680\text{MPa}$ ,  $N_f=9.05\times 10^5$  cycles) (a)the whole fracture appearance; (b)fatigue striation in ferrite and austenite;(c)various characteristics of fatigue striations in ferrite and austenite

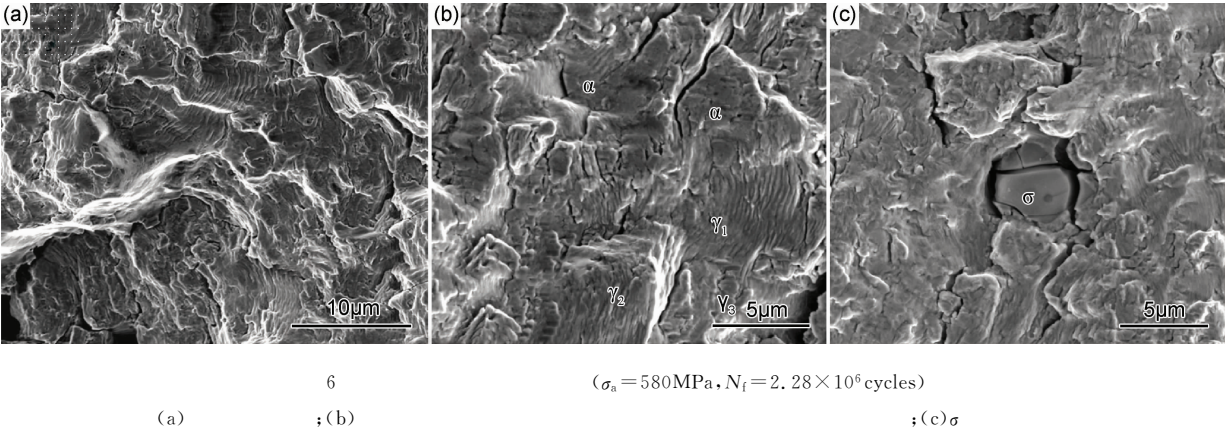


Fig. 6 The fracture morphology in corrosive environment( $\sigma_a=580\text{MPa}$ ,  $N_f=2.28\times 10^6$  cycles) (a)mixed fracture modes; (b)quai-cleavage fracture in ferrite and ductile fracture of fatigue striation in austenite;(c)fracture at  $\sigma$  phase

SAF2507

800~900℃

σ

σ/σ σ/γ

[14] σ

[15] ,σ

σ

7 3 f

(1) SAF2507 10<sup>7</sup> 640MPa, 67%。

3.5% NaCl 90%,

(2)

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