

가

**On the thermal ratchetting test of a discontinuous structure subjected to moving temperature distribution loading**

, , ,

150

가

3mm

6mm

45%

가

17%

가

stiffner

가

가

가

가

**Abstract**

In this study, thermal ratchetting test with the cylindrical structure with plate-to-shell junction subjected to the moving temperature distribution in the axial direction was carried out to investigate the effect of welded junction on the ratchetting behavior. The residual deformation of the discontinuous model with flat plate welded is smaller than that of smooth cylinder model and the residual deformation of the discontinuous model with conical plate welded is larger than that of smooth cylinder model. Due to the limited amount of test data, it is not appropriate to make conclusion on the effect of welded structure yet. Further thermal ratchetting test is planned and the sophisticated inelastic structural analysis has been carried out to understand the influence of the complex residual stress fields in discontinuous region of the structure on the ratchetting behavior of the structure.

1.

150MWe KALIMER(Korea Advanced LIquid MEtal Reactor)[1]  
가 530°C 가  
316  
20cm 가

(progressive inelastic deformation), [2],

[3,4]. [5,6]  
Igari[7,8]

가 가  
Breitbach[10] 가 [9]

[5,6],

2.

2.1

가

Bree[11,12]

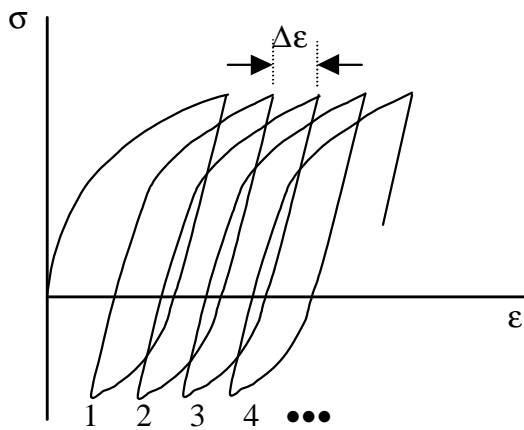
가 ,

Bree Diagram

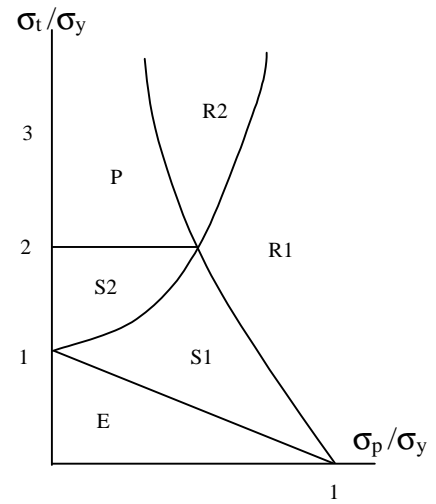
. O'Donnell & Porowski[13,14]

가 가 (Effective Creep Stress) 가

ASME-NH[2]



1.



2. Bree Diagram

Bree Diagram

2

x-

y-

E

, S1

S2

, P

, R1

R2

3

3(a)

(b)

(c)

가

가

(d)

(d)

(e)

(f)

2

S1

가 ( $\sigma_c$ ),

(Core

Stress)

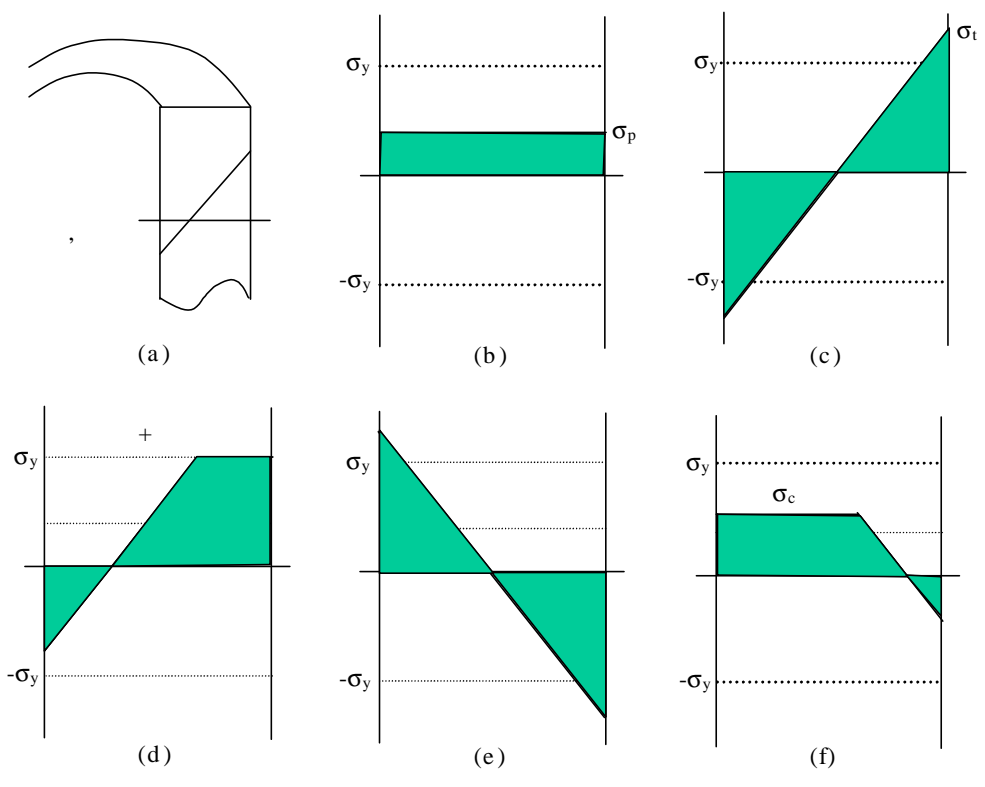
가

3(d)~(f)

가

3

S1



3.

가

(R1)

가

Bree Diagram

가

ASME-NH

Screening Criteria

(upper bound)

ASME-NH T-1320

$$(P_L + P_b/K_t)_{\max} + (Q_R)_{\max} < S_y$$

$$(P_L + P_b/K_t)_{\max}$$

$$, (Q_R)_{\max}$$

$$S_y \quad 1.25S_t$$

가

O' Doennel & Porowski Bree Diagram

가

Z

가

$$\sigma_c = Z \sigma_y$$

ASME-NH

(Isochronous Stress-Strain Curve)

가

1.25

1%,

0.5%

2.2

가

4

가

가

가

가

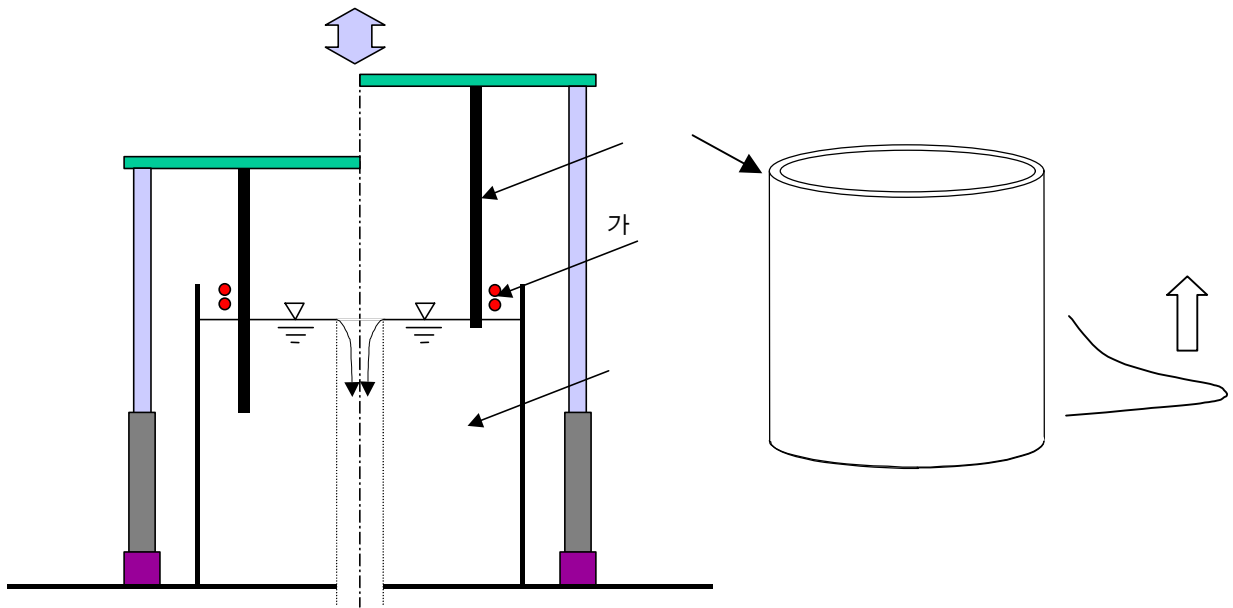
가

가

가

가

가



4.

가

가

가

50KW

50KHz

K-type

1cm

28

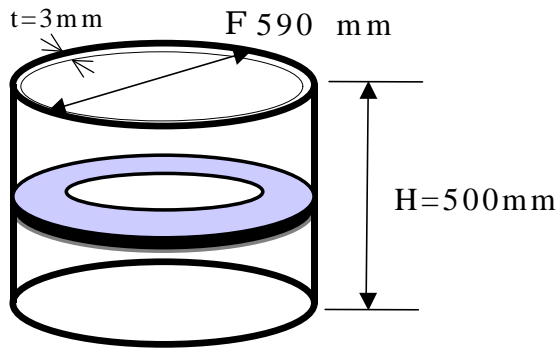
가

가

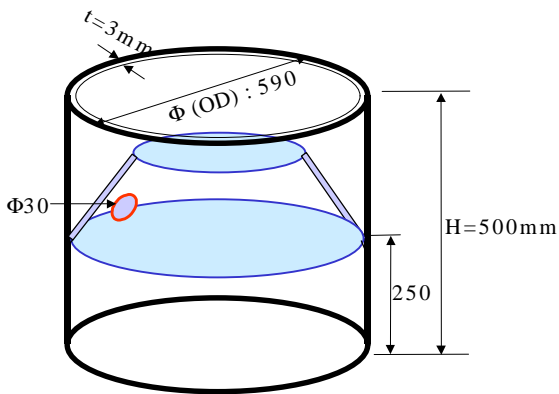
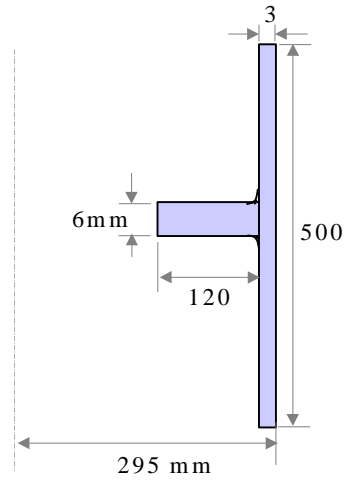
1 Schaevitz LVDT 2  
 500mm, 3mm, 316L

50cm ± 2cm, 가 20μm  
 3  
 가  
 [5] 600mm,  
 5

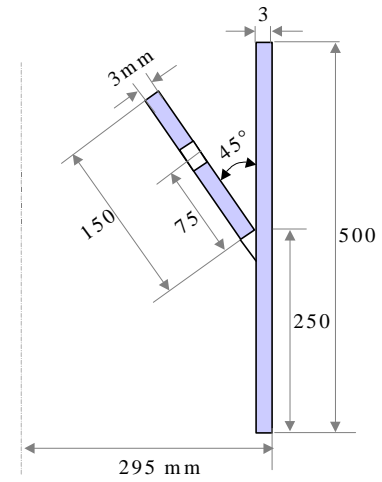
316L



(a)



(b)



$C_L$

5.

5(a)  
 2

3mm 6mm  
 28 1cm

28

가 HP Data Logger

가

4

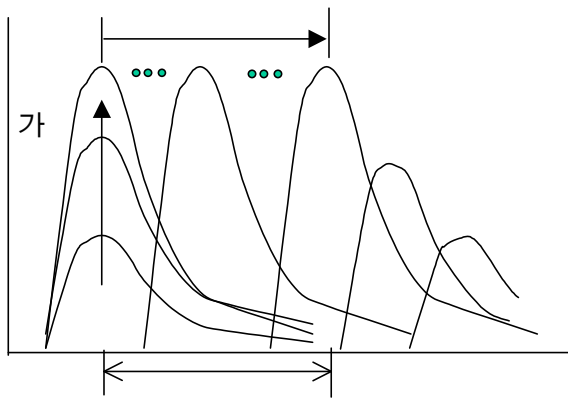
가

2.3

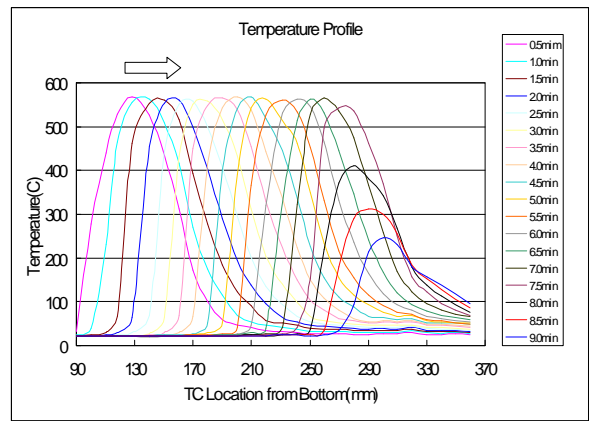
2.3.1

[5] 10

30



(a)



(b)

6.

6(a)

가

가 가

550°C

가

30

가

,

0.35mm/sec

가

가

,

가

10cm

15cm

가

15cm

6(b)

x-

가

y-

9cm

1cm

28

550°C

가

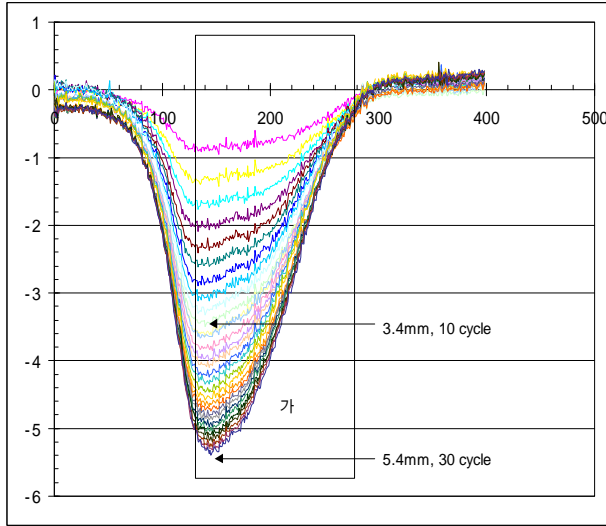
가 50cm

40cm

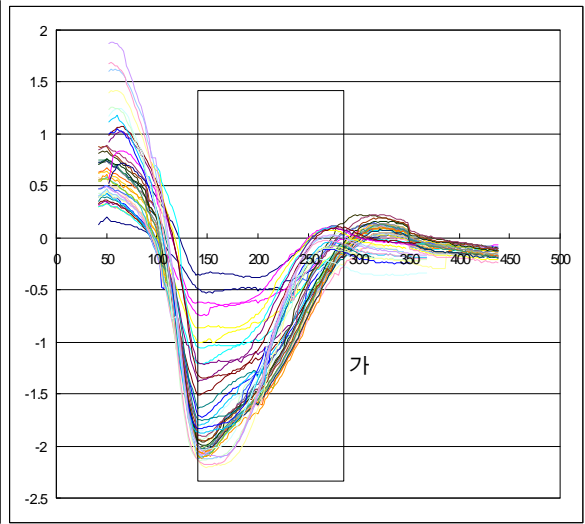
7

(a)

(b) LVDT



(a)



(b)

7.

7(a) 가 가  
 가 30  
 (mm) x- 가  
 가 Cold Front  
 5.4mm 가 가 10 3.3mm, 30  
 가 가 15cm  
 가 가 30 550°C 가 가  
 가 가 가 가  
 7(b) 10 1.85~1.9mm, 30 2.1~2.2mm  
 LVDT 가  
 가 가  
 가 가 가 가  
 가 가 가 가 가 가  
 가 LVDT 가 가 가 가  
 가 가 550°C 가 30  
 가 가  
 LVDT 550°C, LVDT  
 420~425°C



2.3.2

5(a)

~550°

3mm

10cm

17cm~27cm

가

가

8

(a)

가

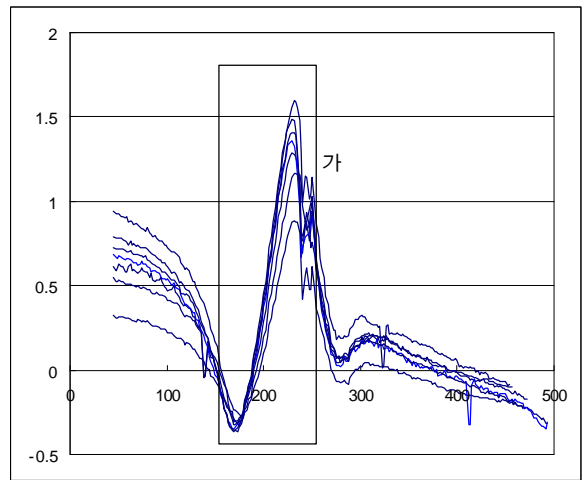
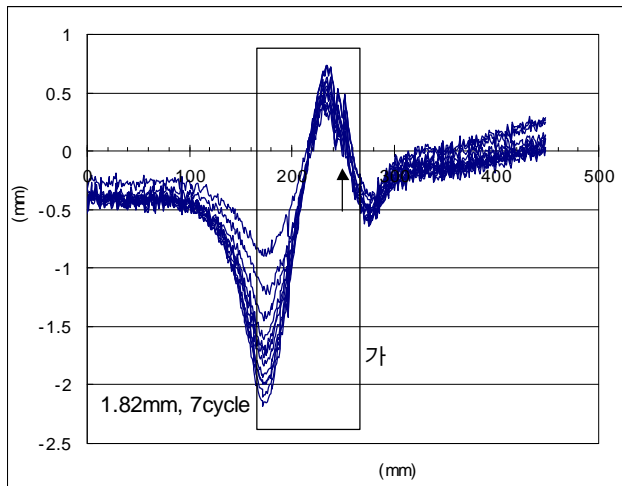
가

가

7

1.82mm 가

2.6mm



(a)

(b)

8.

3mm

8(b) LVDT

LVDT

가

가

가

가

가

(a)

가 가 -

가 6mm

9

~550°

16cm~31cm

15cm

9(a)

8(a)

7

1.88mm

3mm

10

2.25mm

(3.3mm for 10 cycle)

LVDT

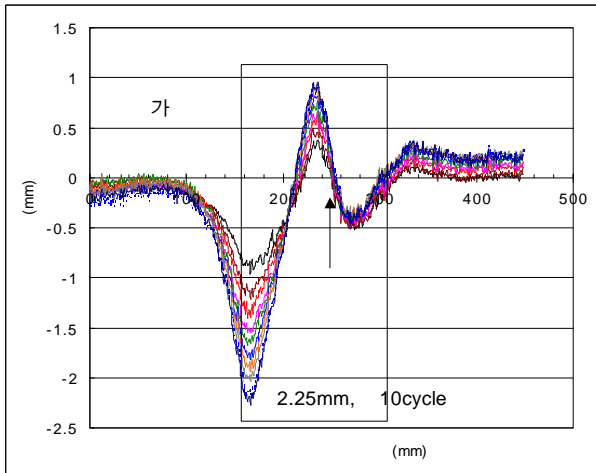
9(b)

(a)

10

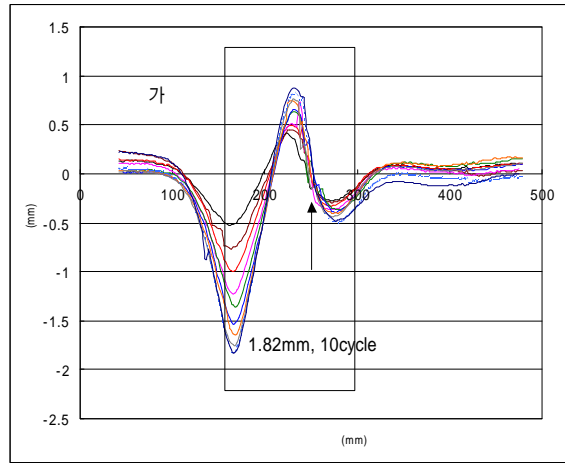
가 1.82mm

가 550°C



(a)

9. 6mm



(b)

2.3.3

5(b)

3mm

~550°

15cm

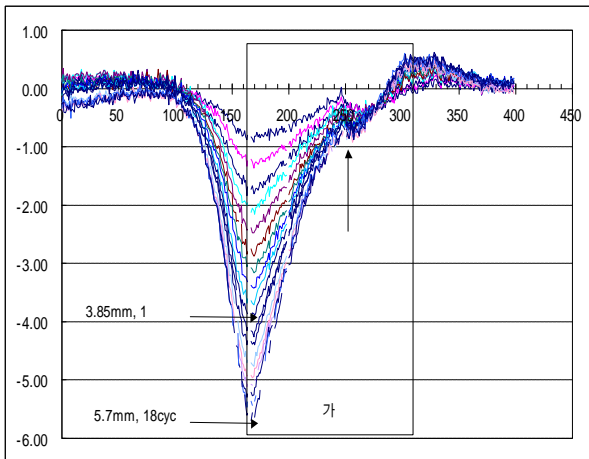
. 가

16cm~31cm

가

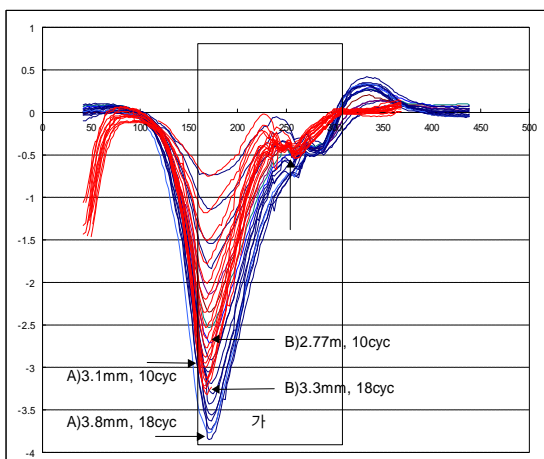
가 가

Y-



(a)

10. 3mm



(b)

10

(a)

가

. 가

가

10

3.85mm 가

3.3mm

18

5.7mm 가

4.2mm

10(b)

LVDT

LVDT(A)

10

3.1mm, 18

3.8mm

LVDT(B)

10

2.77mm, 18

3.3mm

LVDT

가

33~45%

LVDT

가 550°C

가

HP Data Logger

3

가

550°C

가

18

555~560°C

, LVDT(A)

504°C

가 18

490°C

, LVDT(B)

526°C

가 18

520°C

가

11.5~13.5mm, LVDT(A)

15.5~17mm, LVDT(B)

16.5~18.5mm

가

가

90

50~100%

가

3.

가

가

가

3mm

10cm

가

6mm

15cm

가

10

1.8mm

10

3.3mm

45%

15cm

가

10

3.85mm

17%

stiffner

가

가

가

가

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