

## A Study on the High Temperature Corrosion Characteristics of Austenitic Alloys in Lithium Molten Salt

150

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LiCl LiCl-Li<sub>2</sub>O 650 850°C  
LiCl LiCrO<sub>2</sub>가  
LiCl-Li<sub>2</sub>O Li<sub>2</sub>O  
가 LiCl LiCl-Li<sub>2</sub>O  
KSA-4 Cr 가 , Cr 가 Incoloy 800H

### Abstract

Corrosion behaviors of austenitic alloys in molten salts of LiCl and LiCl-Li<sub>2</sub>O were investigated in the temperature range of 650–850°C. In a molten salt of LiCl, a dense protective oxide scale of LiCrO<sub>2</sub> was formed, following growth of oxide scale with parabolic kinetics. Due to Li<sub>2</sub>O-induced basic fluxing mechanism, the corrosion rates of the alloys in mixed molten salt of LiCl-Li<sub>2</sub>O were significantly higher than those in molten salt of LiCl. In a mixed molten salt of LiCl-Li<sub>2</sub>O, an internal oxidation of Cr of the KSA-4 alloy occurred and a porous oxide scale of the Incoloy 800H with higher Cr content was formed.

가 . , ,

, , ,

가  $\text{Na}_2\text{SO}_4$

가 <sup>1, 3)</sup>

<sup>4,5)</sup>

가

<sup>6,7)</sup>,

가

/

,

가 가

<sup>4)</sup> LiCl- KCl

$\text{NO}_3^-$

<sup>8)</sup>

LiCl LiCl-Li<sub>2</sub>O

가

SUS 316L, More 1, Incoloy 800H

KSA-4 LiCl LiCl-Li<sub>2</sub>O

가

2.

Table 1 . KSA-4(Kaeri Superalloy)

KSA-4 1,000

1,200 1,050 1 .

가 (crucible test) .

15(W) x 20(H) x 2.5 mm(T) , 1200

. LiCl

LiCl-Li<sub>2</sub>O 22g 가 .

650, 750 850 , 25 75 .

10% HNO<sub>3</sub>

. 가

, X EPMA

Table 1. Chemical composition of alloys

Alloy	Chemical composition (wt.%)						
	C	Fe	Ni	Cr	Si	Mn	S
SUS 316L	0.023	Bal	12.05	17.19	0.60	0.81	0.003
More 1	0.52	Bal	35.8	25.0	0.39	0.45	-
Incoloy 800H	0.08	Bal	31	22	0.53	1.07	0.006
KSA-4	<0.03	Bal	36	8	<0.5	<0.5	<0.03

3.

Fig. 1 650, 750 850 LiCl 25

. Fig. 1

Cr 가 가

Fig. 2 LiCl-Li<sub>2</sub>O 650, 750 850 25

. Fig. 2

750 가

. Fig. 1 2

650

가

LiCl-Li<sub>2</sub>O

가

가

850

LiCl

3 19

Li<sub>2</sub>O

가

Li<sub>2</sub>O가

O<sup>2-</sup>, Li<sub>2</sub>O 가

가

가

Fig. 3

750

LiCl

. Fig. 3

<sup>9)</sup>. Fig. 1

가

Fig. 4 750

LiCl-Li<sub>2</sub>O

Fig. 4

Cr 가

가

가

Cr 가

, Fig. 2

가

Fig. 5

LiCl-Li<sub>2</sub>O

Li<sub>2</sub>O

25

Li<sub>2</sub>O

. 750

Li<sub>2</sub>O

가

5%

가 가

,

가 가

. 750

KSA-4, Incoloy 800H, SUS 316L

More 1

가

, Fig. 2 750

Fig. 6 More 1 Incoloy 800H LiCl-Li<sub>2</sub>O Li<sub>2</sub>O 25  
 Li<sub>2</sub>O . 750 Li<sub>2</sub>O  
 가 5% 가 가 , 가  
 . 800 Li<sub>2</sub>O 18% 가 가 가  
 O<sup>2-</sup>  
<sup>2)</sup>, Fig. 6 Li<sub>2</sub>O . 750 Li<sub>2</sub>O 가  
 5% , 5% Li<sub>2</sub>O 가 O<sup>2-</sup> 가 가 가 Li<sub>2</sub>O  
 가 5% O<sup>2-</sup> 가 가 가  
 . 가 가 Li<sub>2</sub>O 가 가 Li<sub>2</sub>O  
 . Fig. 2 가  
 가가 , 750 가 가 가  
 가 가 Li<sub>2</sub>O 가 가가

Fig. 7 750 25 KSA-4 X-  
 Fig. 7 LiCrO<sub>2</sub> .  
 LiCrO<sub>2</sub> Cr Cr 가 LiCrO<sub>2</sub>  
 Cr 가 가 가 .

Fig. 8 LiCl 750 25 KSA-4 Cr, O  
 . Fig. 8 Cr  
 O 가 . Fig. 7 X  
 LiCrO<sub>2</sub> .

Fig. 9 LiCl-Li<sub>2</sub>O 750 25 Incoloy 800H  
 .  
 X- Fig. 10 . Fig. 10 LiCrO<sub>2</sub>  
 Ni .

4.

1. LiCl, LiCrO<sub>2</sub>, LiCl-Li<sub>2</sub>O, Cr 가
2. 가 가 가, LiCl-Li<sub>2</sub>O 가 가가, 750 가

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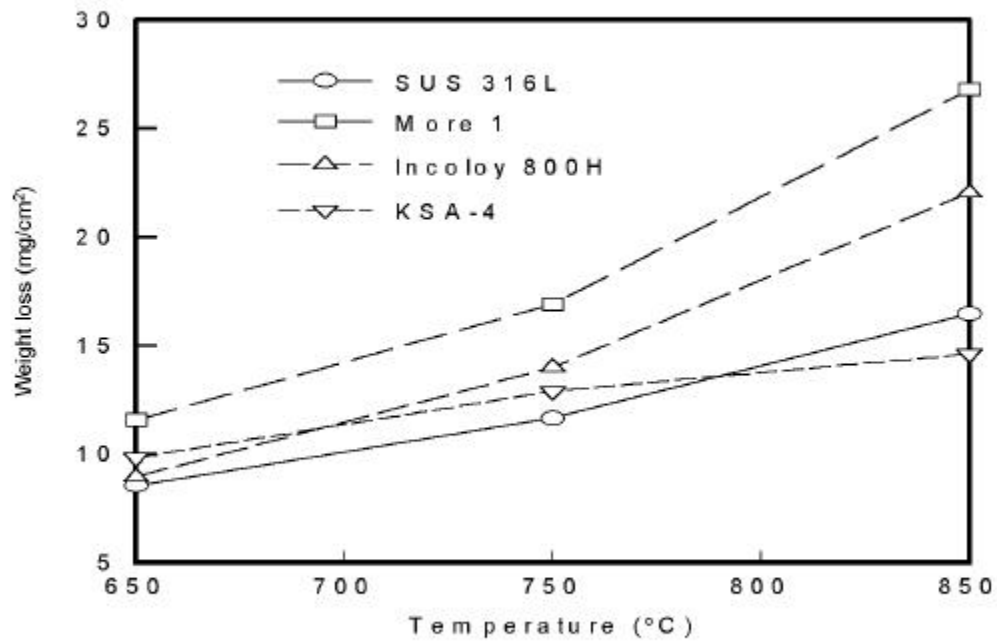


Fig. 1. Weight loss of the alloys corroded in molten salt of LiCl for 25 hours, as a function of temperature.

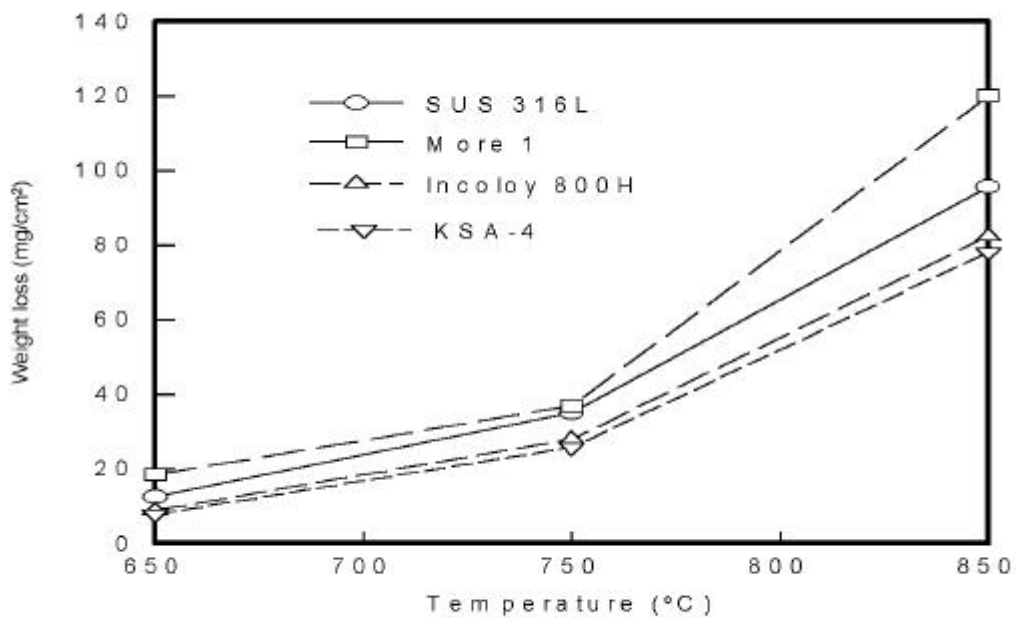


Fig. 2. Weight loss of the alloys corroded in molten salt of LiCl-Li<sub>2</sub>O for 25 hours, as a function of temperature.

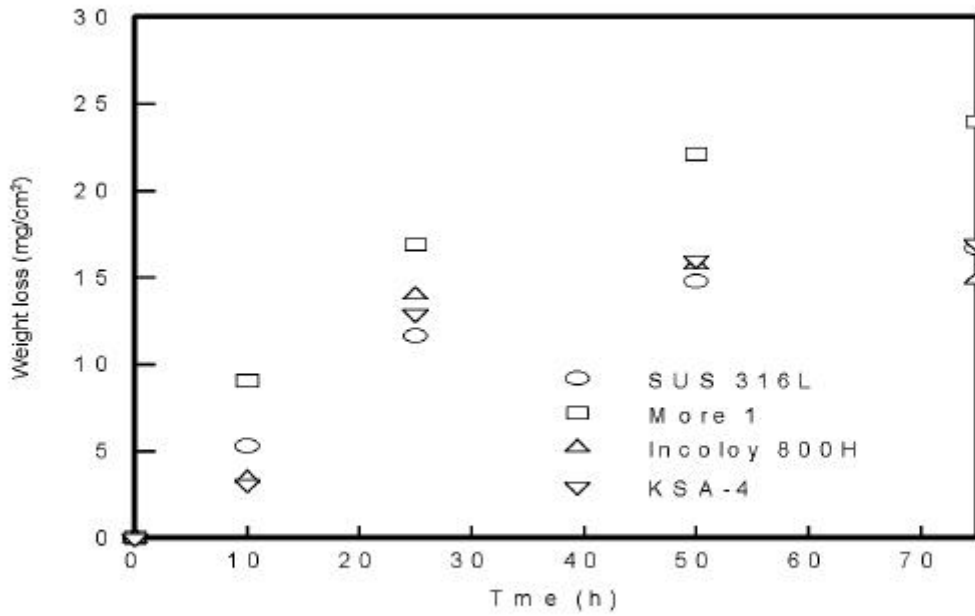


Fig. 3. Weight loss of the alloys corroded in molten salt of LiCl at 750°C, as a function of time.

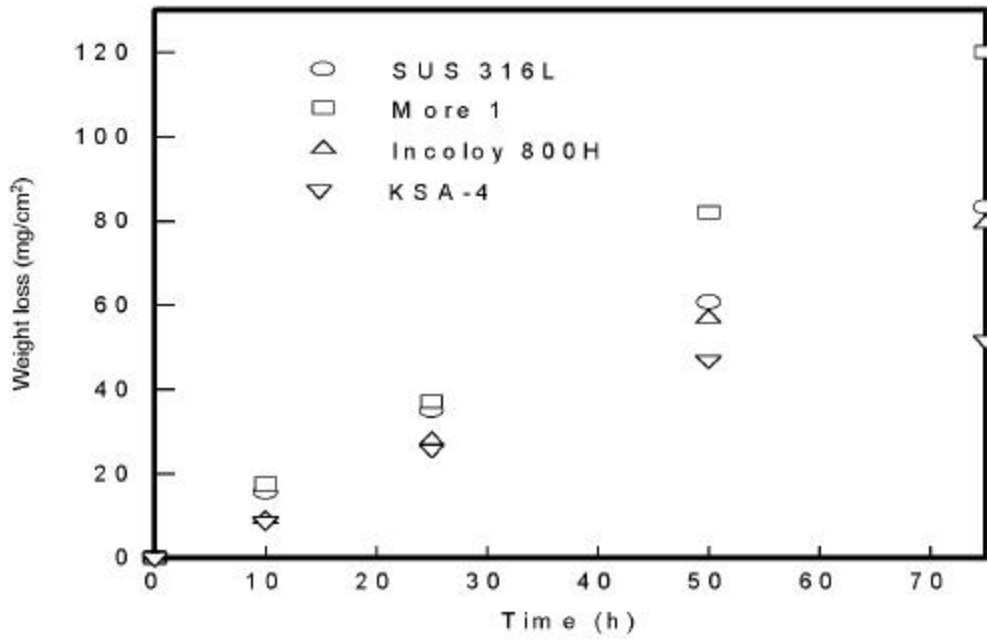


Fig. 4. Weight loss of the alloys corroded in molten salt of LiCl-Li<sub>2</sub>O at 750°C, as a function of time.



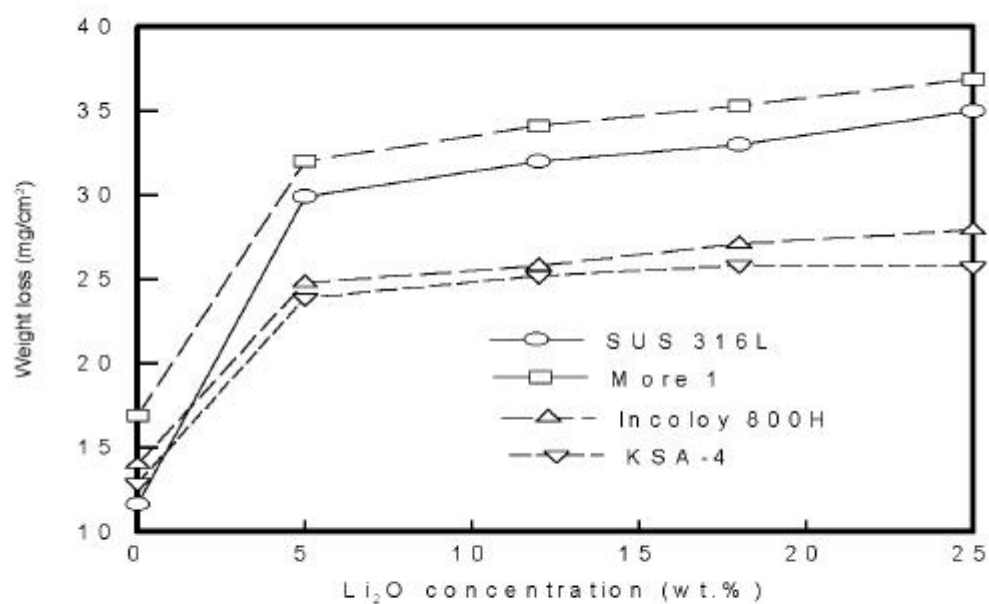


Fig. 5. Effect of Li<sub>2</sub>O concentration on the weight loss of the alloys corroded in molten salt of LiCl-Li<sub>2</sub>O at 750°C for 25 hours.

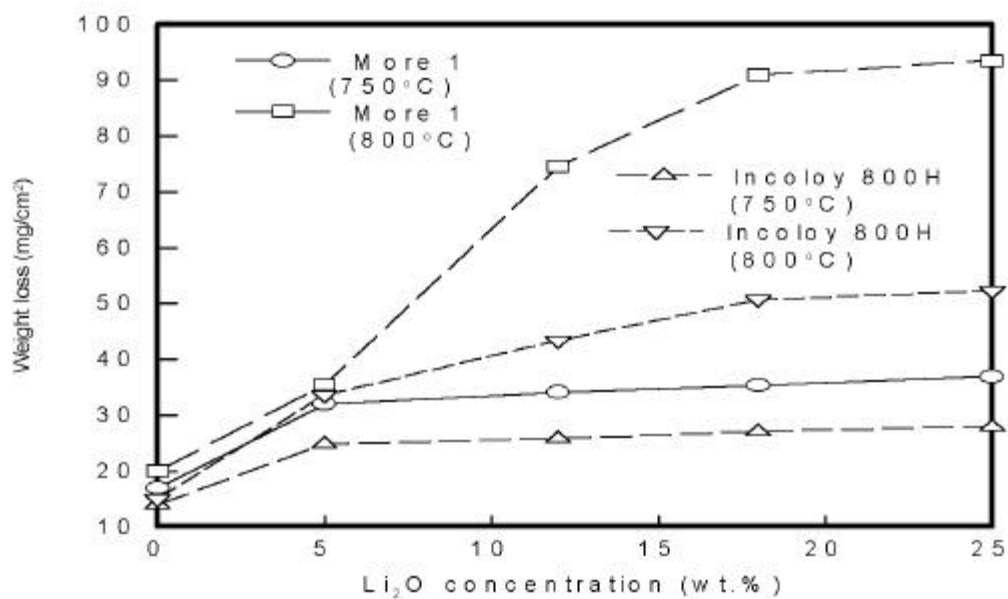


Fig. 6. Effect of Li<sub>2</sub>O concentration on the weight loss of More 1 and Incoloy 800H corroded in molten salt of LiCl-Li<sub>2</sub>O for 25 hours.

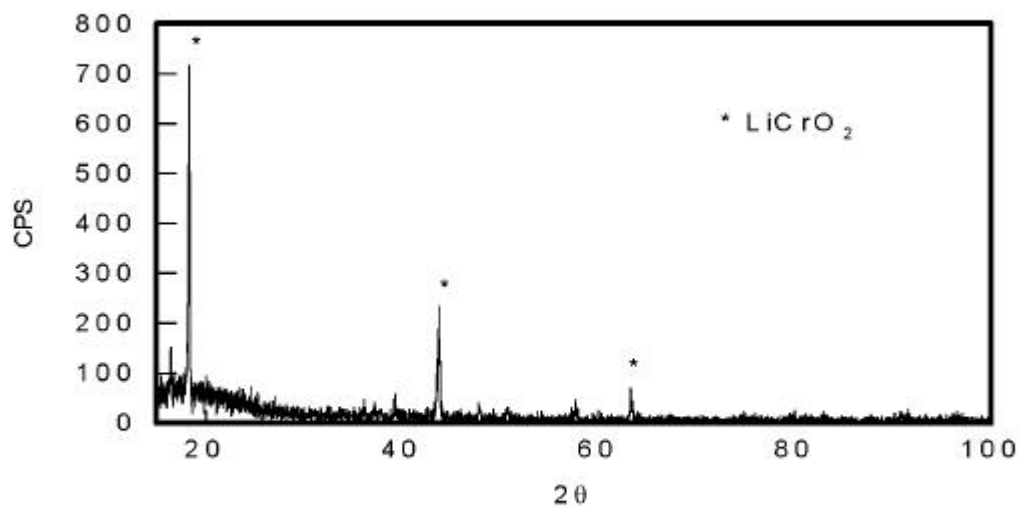


Fig. 7. X-ray diffraction patterns of the oxide scale on KSA-4 corroded in molten salt of LiCl at 750°C for 25 hours.

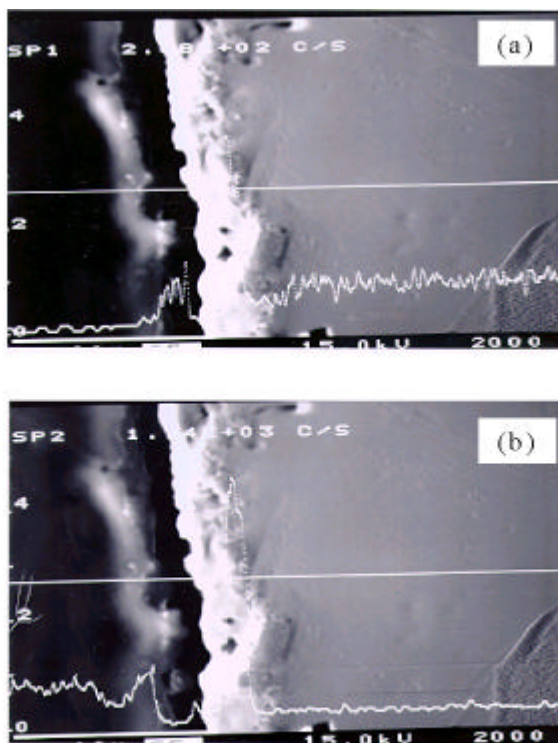


Fig. 8. Microstructure and X-ray line scan of the scale on KSA-4 alloy corroded in molten salt of LiCl at 750°C for 25 hours, (a) Cr (b) O.

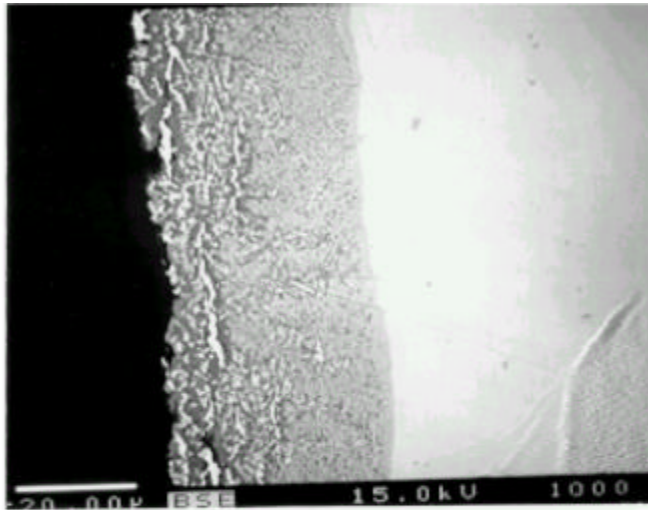


Fig. 9. Scanning electron micrograph of cross section of Incoloy 800H corroded in molten salt of LiCl-Li<sub>2</sub>O at 750°C for 25 hours.

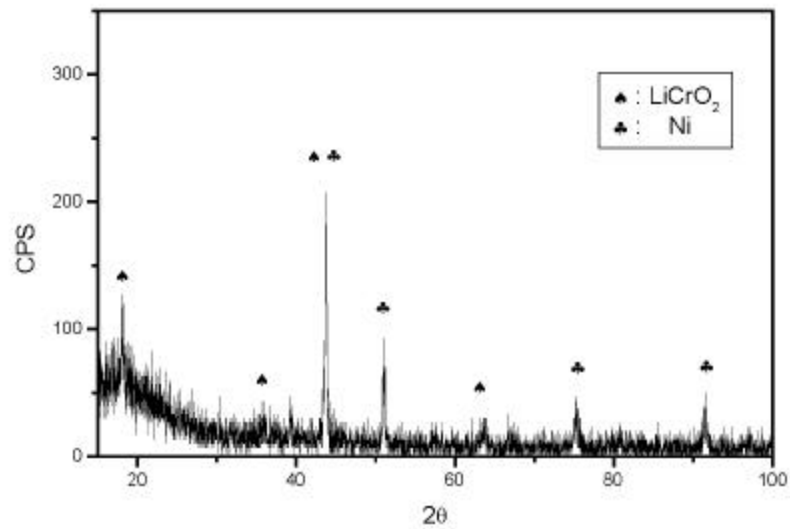


Fig. 10. X-ray diffraction patterns of the oxide scale on Incoloy 800H corroded in molten salt of LiCl-Li<sub>2</sub>O at 750°C for 25 hours.