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The Electropolishing evaluation for the internal surfaces of the channel head  
of the Nuclear Steam Generator

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(ElectroPolishing) (Mechanical Polishing) 가

**Abstract**

The channel head of the Nuclear Steam Generator has finally finished grinding work after welding divider plate. Then the roughness in the internal surfaces of the channel head got worse. When the Steam Generator is maintained or repaired, there is some problem of worker radiation exposure because of radioactivity accumulation and damage of corroison.

The purpose to reduce the radioactivity accumulation and damage of corroison has investigated Mechanical Polishing & ElectroPolishing to be manufactured the Internal Surfaces, Divided Plate & Manway Cover in Nuclear Steam Generator. In this paper , the characteristics of  $\delta$ -Ferrite, thickness reduction, roughness in electropolishing for the Steam Generator channel head are evaluated. Based on these results, the parameter of electropolishing is established.

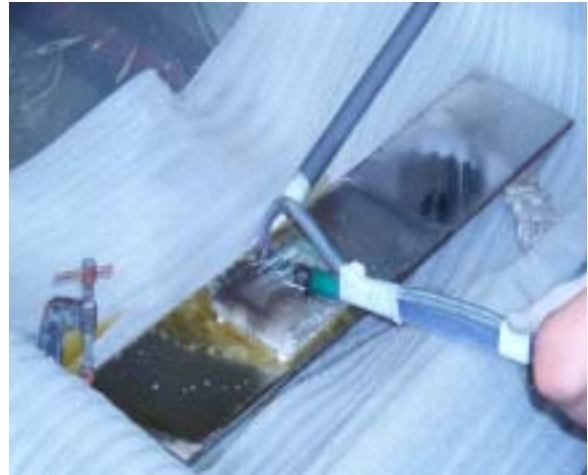
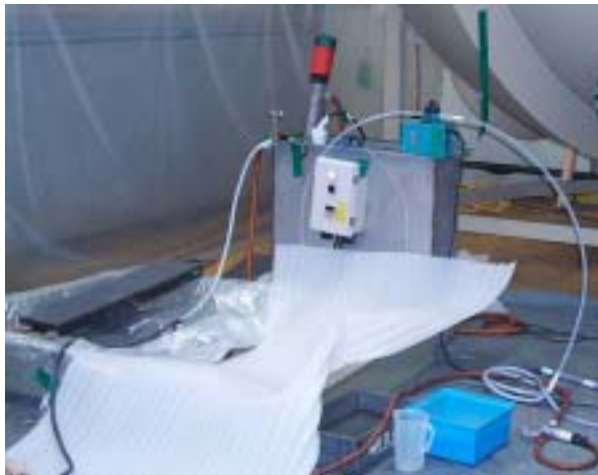
1.

U-tube 가 1  
(Primary Coolant) (Feed Water) U-Tube  
Channel Head 1 /

	1	가	Channel Head	Stainless Steel	Cladding	
		Hot Part	Cold Part		Divider Plate	
Inconel 690						1
가			가			
가						
Head Cladding		(Mechanical Grinding)		Divider Plate	Channel	
				가	EPRI	
			Channel Head			

2.

			Stainless steel	cladding	Bent	
Plate(200 × 1000mm)		Inconel 690(200 × 1000mm)				1
	1					
		2:8				



1. Parameter

Alloy	No	MP	[A/in <sup>2</sup> ]	EP [sec]	[°C]
Stainless Steel Clad	S1	#100 → #180 → #320 → #400	3.9	90	45 ± 5
	S2		5.2		
	S3		6.5		
	S4		7.7		
Inconel 690	I1		3.9	80	
	I2		5.2		
	I3		6.5		
	I4		7.7		

3.

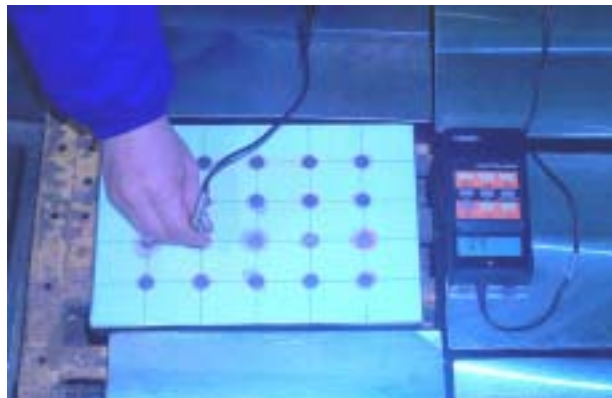
3.1 [FN]

2 Stainless steel cladding Bent Plate 308L Stainless Steel  
 가 Clad δ-Ferrite  
 가 . 10 ,  
 δ-Ferrite , δ-Ferrite  
 가 . 2 δ-Ferrite .

2 Bent Plate

: FN

No	As-received	MP	EP
Bent Plate	6.8 ~ 7.2	6.7 ~ 7.6	6.6 ~ 7.6



3.2

3 3.1 cladding Bent Plate Inconel 690 Plate  
 Bent Plate 0.23mm 0.37mm  
 , Inconel 690 Pate 0.24mm 0.28mm UT  
 , Clad 가 Base Metal

3 ( :mm)

No	As-received	MP	EP
Bent Plate	75.05 ~ 75.62	74.91 ~ 75.36	74.81 ~ 75.27
Inconel 690	52.49 ~ 52.62	52.35 ~ 52.45	52.24 ~ 52.36

3.3

4 3.1 Bent Plate Inconel 690 Plate ,  
 EPRI 가 MP (60µin)/EP ( 25µin ) Ra

4 ( :µin)

No	As-received	MP	EP
Bent Plate	67.7	14.1	5.1
Inconel 690 plate	175.65	13.4	4.1

4 가 10µinch Ra

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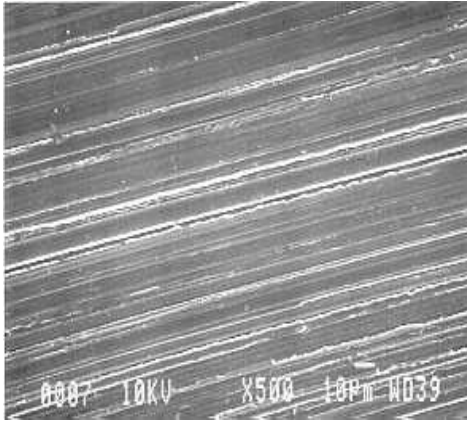
3.4

Pitting Intergranular Attack(Inconel 690), Interdendritic Attack(Stainless Steel Clad), Grainboundary 가

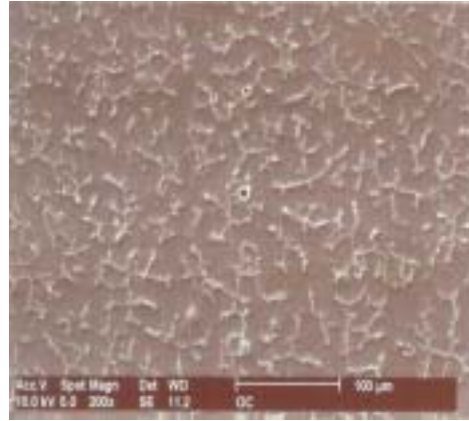
3 Stainless steel cladding Bent Plate , Inconel 690 Plate

SEM Interdendrite attack Inconel 690

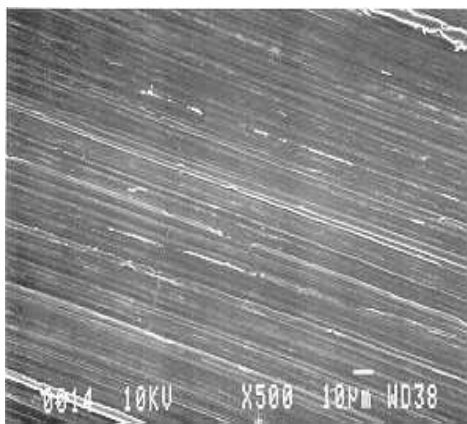
Intergranular attack



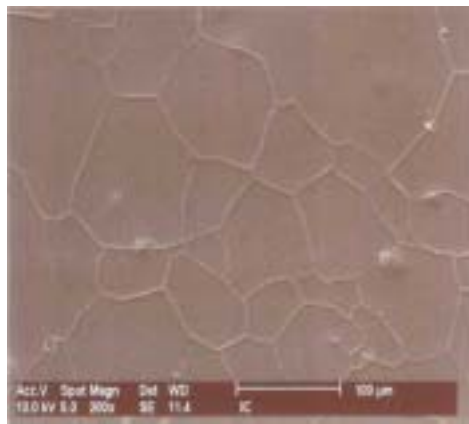
Stainless steel Clad (As-received)



Stainless steel Clad(EP)



Inconel 690(As-received)



Inconel 690 (EP)

3.

4.

Channel Head

$\delta$ -Ferrite

Stainless Steel clad

80sec

Attack

6.5A/in<sup>2</sup>,

90sec, Inconel 690

6.5A/in<sup>2</sup>,

1)  $\delta$ -Ferrite

$\delta$ -Ferrite

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Cladding

Channel Head

가

$\delta$ -Ferrite

$\delta$ -Ferrite

2)

Spec.	Cladding	Inconel Plate	
Inconel 690 plate	0.24 ~ 0.28mm		Stainless Steel Cladding 0.23 ~ 0.37mm,

가

3)

EPRI		Channel Head	Divider Plate
25μinch Ra		Guide Line	
		Stainless Steel Clad	5 ~ 6 μinch Ra , Inconel 690 3 ~ 6 μinch

Ra EPRI

4)

Pitting			SEM	Stainless Steel Clad
6.5A/in <sup>2</sup> ,	90sec	, Inconel 690	6.5A/in <sup>2</sup> ,	80sec
	가	6.5A/in <sup>2</sup>	Pitting	
grainboundary 가		, 6.5A/in <sup>2</sup>		Pitting

5.

- [1] EPRI NP-6617, January 1990, "Electropolishing Qualification Program for PWR Steam Generators Channel Heads "
- [2] EPRI NP-6619, April 18. 1991, "Electropolishing Process Development, PWR Steam Generators Channel Heads"
- [3] ASTM A 262, Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steel