

Mount Method of Specimens for Micro-surface Analysis of Radioactive Materials

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Abstract

The examination of spent nuclear fuels and radioactive materials by using scanning electron microscope(SEM) plays an important role in their development for energy systems as well as providing data for basic mechanism involved in corrosion, radiation damage, fracture, etc. To conduct this type of work, main body of the SEM usually removes from control console and places it in a shield or containment facility so that it can be operated remotely. To apply the most proper analysis system to spent nuclear fuels and radioactive materials at Post-Irradiation Examination Facility(PIEF) in KAERI, accordingly, the SEM was modified and installed in shielded glove box. Also, a mount method by using conductive resin and low melting metal was used to fabricate easily radioactive specimens.

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(shielded glove box)

(detector)

가

(manipulator)

가

가

가

1.

[1 6]

0.5 Sv/h 1.26

Sv/h

0.5 Sv/h

가

50 GWD/MTU,

3

, 5%

0.17 gr

0.2 ci

가

가

(SED, BED, EDX)

가 PHILIPS XL-30 가 , 가 가

(acrylate conductor) (glass light)
(super ultra thin window) 가 EDX (Be)

6m , Fig. 1 2
20cm 30cm ,
(column) 3cm 5cm 가
(frame)

LaB6 (scan filtering) (noise)
FEG (holder)

2.

[7] (Radiological Protection Regulations)

8.5cm, 16.5cm

(utility lines) (, ,)
(port) , 가

, , 2 , , 3
(cask adapter)

2.07m, 2.62m, 2.62m . 17cm

2 가

. Fig. 3

, Fig. 4

가

가

1cm 가

가

(manometer)

(HEPA filter)

(storage rack)

3

60cm

1.

(Specimen Chamber) Stub

9407

(polishing) (etching)

SC7610 Sputter Ion Coater

stub

Table 1. Pre-Mount according to Heating Conditions

	Heating			Cooling (min)	(mm)	(mm)	
	(min)	()	(kN)				
1	6	180	20	2	31.7	19.9	Mount
2	1.5	180	10	2	31.7	21.9	
3	1.5	180	5	2	31.7	23.2	Pre-Mount
	6	180	20	2	31.7	19.9	Mount

* Hot Mounting Press 1.25 inch, PolyFast 23MØ

(tape)

(paste)

PolyFast
Hot Mounting Press STRUER
PREDOPRESS PolyFast Pre-Mount
PREDOPRESS Pre-Mount
PolyFast Hot Mounting Press 30mm
1.25 inch PolyFast 23MØ 180 6 가 20kN
가 (press) 2 [8].
PolyFast
PolyFast PREDOPRESS 가
가 Pre-Mount
PREDOPRESS 가 Table 1
가 가 Pre-Mount
PolyFast
20kN 180 6 가 가 2
31.7mm 19.9mm
가 Pre-Mount
PolyFast 10kN 1.5 가 가 2
31.7mm 21.9mm
5kN 1.5 가 가 2
31.7mm 23.2mm

가 , Pre-Mount 180 5kN,
 가 1.5 , 2 , PREDOPRESS
 PREDOPRESS 30mm

2.

가 ,

4kW ,
 Holder,
 Mount Mount Mount ,
 , Holder, Mount Mount ,
 60 75
 / (58:42 wt%) / / / (50:26.7:13.3:10 wt%)

Mount

Mount
 31.7mm, 19.9mm ,
 20mm, 10mm 가 3MØ
 Mount
 60 75 Holder
 (12MØ) 100 , 0.5A 1.1
 kW 가 90 가
 , 100 40
 40
 200 170
 , 30 0.7A
 1.5kW가 7

8 가 , 가 200 ,
0.7A 1.5kW .

1000 가 10kV, spot size 5.0

5000 10000 , 가 20kV , spot size 5.0

. Fig. 5

(grain boundary)가

, Fig. 6

가

Pellet

Pellet

1000

5000

가

20kV, spot

size 4.0 5.0

. Fig. 7

Pellet

, Fig. 8

Pellet

가

가

가 가

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- [2] BNL, "A Fully Shielded & Analytical Scanning Electron Microscope for the Examination of Radioactive Materials", EMAG-91, 1991
- [3] INEL, "Operation of a Scanning Electron Microscope in a Hot Cell", DE88-006775, 1987.
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- [6] CDNG, "Laboratories Chauds et Télém manipulations de La C.E.E." CEA-CONF 5723, 1981.
- [7] " ()", KAERI/T S- 25/97, 1997.
- [8] "Hot Mounting Resins", www.struers.com/appguide.htm, 1999.

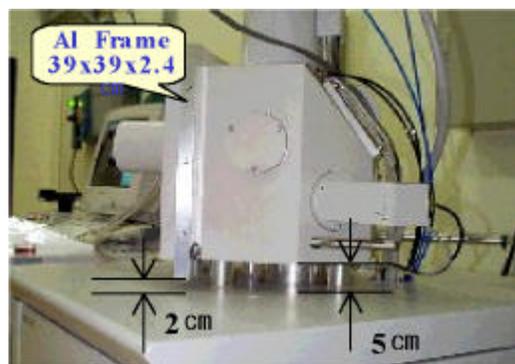


Fig. 1. Modification of the Column.

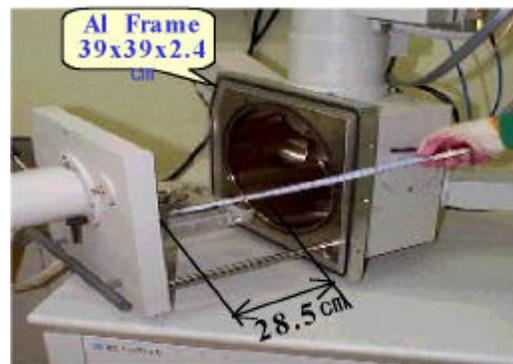


Fig. 2. Modification of the Stage Door.

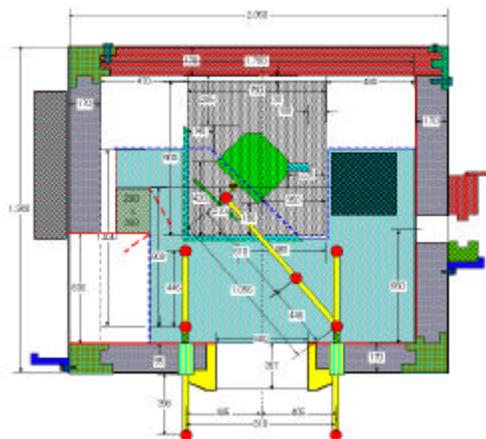


Fig. 3. Configuration of the Shielded Glove Box.



Fig. 4. SEM in the Shielded Glove Box.

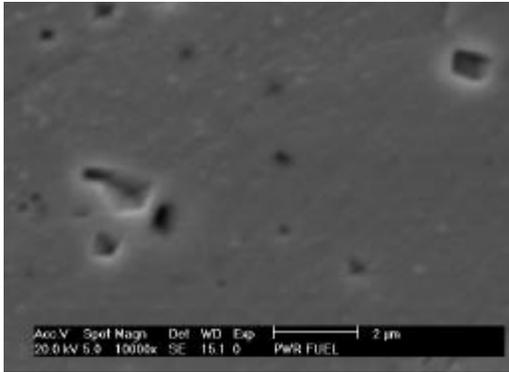


Fig. 5. Image of the PWR Fuel using General Resin Mount ($\times 10000$, 20kV).

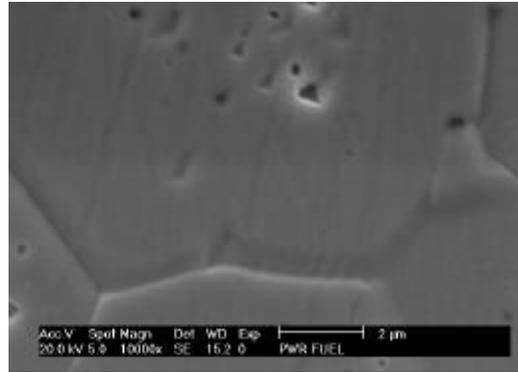


Fig. 6. Image of the PWR Fuel using Conductive Resin Mount ($\times 10000$, 20kV).

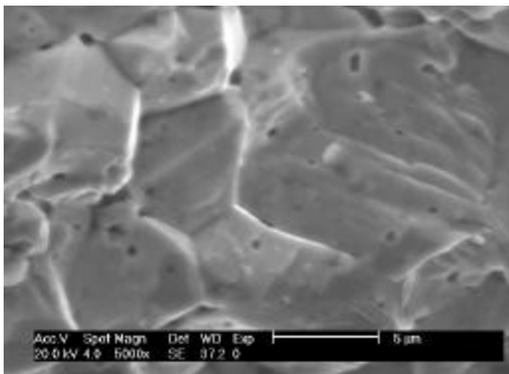


Fig. 7. Image of the Fuel Fracture Face using General Aluminum Mount ($\times 5000$, 20kV).

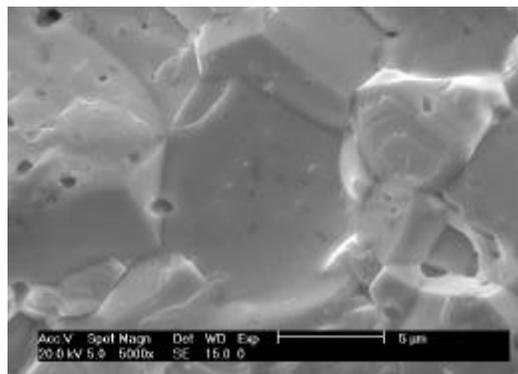


Fig. 8. Image of the Fuel Fracture Face using Low Melting Metal Mount ($\times 5000$, 20kV).

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