

가

### Irradiation Test of Dry Fabricated Fuel in HANARO

305-353

150

가

가

OR4

48.9 kW/m

2,251

가

2,590

2,252

2001 6

2002 2

8

30 kW/m

40 kW/m,

3,500

MWd/tHM

IMEF

#### Abstract

Irradiation test of pellets fabricated from spent PWR fuel by a dry process was performed in the HANARO research reactor. Maximum linear element rating and centerline temperature in the OR4 hole were estimated to be 48.9 kW/m and 2251 , respectively, under the steady state condition. Under the reactivity insertion accident and the locked rotor accident postulated in HANARO, maximum centerline temperatures were calculated to be 2590 and 2,252 , respectively. From these analysis results the integrity of the elements for the irradiation test in HANARO was confirmed. The test had been done for 8 months, from June 2001 to February 2002. Average and maximum linear powers during the period were estimated to be 30 kW/m and 40 kW/m, respectively, and average discharge burnup to be 3,500 MWd/tHM. Irradiated fuel is under the post irradiation examination in IMEF.

1.

가

가

(Direct Use of Spent PWR Fuel in CANDU Reactors, DUPIC)

- - - IAEA

DUPIC

가  
 (Oxidation and Reduction of Oxide Fuel)  
 DUPIC  
 10  
 IAEA DUPIC

(Irradiated Material Examination Facility, IMEF)

DUPIC  
 DUPIC  
 DUPIC  
 , 2000  
 60 kW/m  
 MWd/tHM  
 2001 OR4  
 3  
 DUPIC  
 1770

2.

DUPIC 3  
 ( : 59.2 kW/m)  
 2000 5 2 2 DUPIC 3

OR4 가  
 SPND , SPND  
 DUPIC System 3  
 (PIEF) 1986 1  
 (G23) (G2)

DFDF(DUPIC Fuel Development Facility)  
 DUPIC 1 3  
 5  
 (=10.784 g/cm<sup>3</sup>) 95% . DUPIC 10.23 g/cm<sup>3</sup> 1

DUPIC  
 U-235 : 6.20 mg/g  
 Pu-239/241 : 4.76 mg/g, 0.599 mg/g  
 : Zircaloy - 4

: 199.82 mm (Endcap )  
 : 10.80 mm, 0.66 mm  
 가 : He, 1.3  
 : spacer, (5), spacer, plenum, spring  
 : 3 , cooling block  
 3 SPND 가 OR4 DUPIC 8  
 : OR4  
 : 24 MW  
 : 9.6 kg/sec  
 : 0.4 MPa

3.

3.1

MCNP 24 MW  
 DUPIC 가 가 가  
 (HANAFMS) 가 , 가  
 DUPIC /  
 . 3 DUPIC ,  
 9.049 m/s  
 40 , 가  
 (RIA, Reactivity Induced Accident),  
 (Locked Rotor Accident) 가  
 HANAFMS  
 FEMAXI-IV  
 MARS ( : 2,668 , ONB: 125 )  
 가

3.2

1999 2000 DUPIC  
 3 DUPIC  
 24.25 30cm , 2  
 15 20cm DUPIC

DUPIC

가  
 . DUPIC  
 26.39/28.83 \*  
 MCNP  
 , 0.0621  
 0.98%  
 가  
 600mm: 38.9kW/m × 1.172 × (1+0.0621) × 1.0098 = 48.90 kW/m  
 FEMAXI-IV  
 DUPIC  
 MARS  
 가 DUPIC 가 600 mm  
 48.9 kW/m FEMAXI-IV MARS DUPIC  
 2 2114 2251 (2668 )  
 , 84 79 (125 )  
 3.3 가  
 I II 가  
 DUPIC FEMAXI-IV 2  
 , 3.77 129.3% FP 가  
 , MDNBR  
 0.5 1.1  
 FEMAXI-IV , DUPIC 2590.9  
 2665 , 96.4  
 , MARS 가  
 , MDNBR 18.5 가 2604 85  
 III IV 가  
 2 63%F.F  
 FEMAXI-IV 3  
 2094.0 , 83.8  
 가 MARS  
 105 , MDNBR 15.1 가 , MARS 가 2502

4.

DUPIC 3 2001 6 5 2002 2 5  
 8 . 4 ,  
 40 kW/m, 30 kW/m, 3  
 3,500 MWd/tHM 가 .  
 DUPIC .

5.

OREOX 가 DUPIC 가  
 . OR4  
 48.9 kW/m 2,251  
 가 ,  
 2,590 2,252 .  
 3 8 ,  
 30 kW/m 40 kW/m,  
 3,500 MWd/tHM . 가

1. M.S. Yang et al., "Prospect and Challenges of DUPIC Development in Korea," Proceedings of the 11th Pacific Basin Nuclear Conference, Seoul, Korea (1998)
2. J.S. Lee et al., "The DUPIC Alternative for Backend Fuel Cycle and Reactor Strategies," Vienna, Austria (1997)
3. , " DUPIC 가," 2001 (2001)
4. , "DUPIC SPND ," 2002 (2002)
5. , 3 DUPIC , KAERI/TR-1830/2001, (2001)

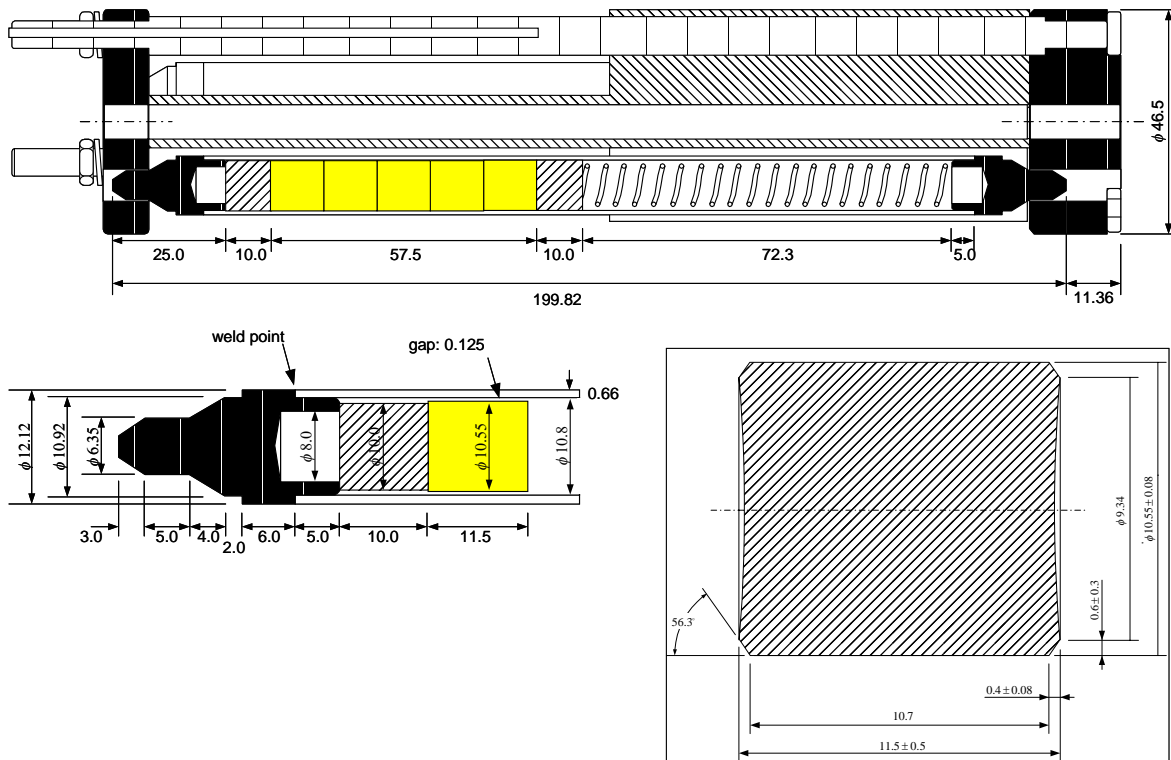
1. 3

DUPIC

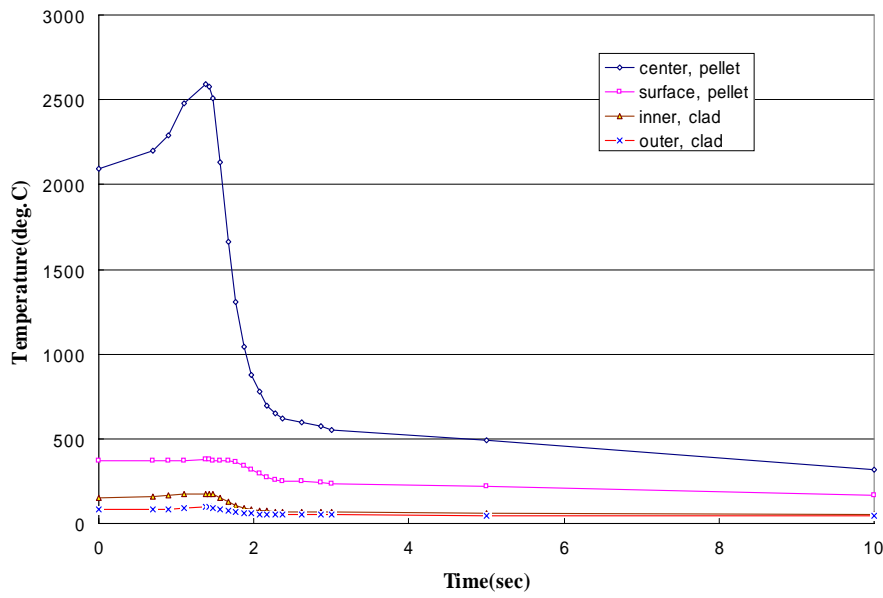
<i>Nuc.</i>	<i>A</i>	<i>Weight (g)</i>	<i>Nuc.</i>	<i>A</i>	<i>Weight (g)</i>	<i>Nuc.</i>	<i>A</i>	<i>Weight (g)</i>
N	14	2.20E+01	PD	104	2.32E+02	SM	147	1.85E+02
O	16	1.19E+05	PD	105	3.59E+02	SM	148	1.69E+02
O	17	4.83E+01	PD	106	3.36E+02	SM	149	2.97E+00
O	18	2.74E+02	PD	107	2.07E+02	SM	150	2.80E+02
F	19	9.51E+00	PD	108	1.42E+02	SM	151	1.15E+01
NA	23	1.33E+01	PD	110	4.66E+01	SM	152	1.20E+02
MG	24	1.42E+00	KR	84	1.06E+00	SM	154	3.48E+01
AL	27	1.48E+01	KR	86	1.77E+00	EU	151	1.22E+00
SI	28	9.88E+00	RB	85	1.04E+00	EU	153	1.14E+02
P	31	3.11E+01	AG	109	7.05E+01	EU	154	1.15E+01
CL	35	3.20E+00	CD	110	9.28E+00	EU	155	1.97E+00
CL	37	1.19E+00	CD	111	7.14E+00	GD	154	2.43E+01
CA	40	1.72E+00	CD	112	5.19E+00	GD	155	1.02E+01
V	51	2.64E+00	CD	114	7.38E+00	GD	156	5.99E+01
CR	52	2.99E+00	CD	116	2.28E+00	GD	158	1.80E+01
MN	55	1.46E+00	SN	116	8.83E+00	GD	160	1.68E+00
FE	56	1.47E+01	SN	117	7.76E+00	TB	159	2.48E+00
NI	58	1.42E+01	SN	118	8.42E+00	U	234	1.78E+02
NI	60	5.80E+00	SN	119	7.84E+00	U	235	6.20E+03
ZN	64	1.70E+01	SN	120	8.84E+00	U	236	3.61E+03
ZN	66	1.01E+01	SN	122	8.61E+00	U	238	8.38E+05
ZN	67	1.49E+00	SN	124	1.17E+01	U	239	0.00E+00
ZN	68	7.00E+00	SN	126	2.53E+01	NP	237	4.60E+02
RB	87	2.27E+00	TE	128	1.02E+00	PU	238	1.44E+02
SR	88	3.25E+02	TE	130	3.30E+00	PU	239	4.76E+03
SR	90	3.59E+02	I	129	1.66E+00	PU	240	2.01E+03
Y	89	4.24E+02	CS	133	1.04E+01	PU	241	5.99E+02
ZR	90	1.56E+02	CS	135	3.43E+00	PU	242	4.51E+02
ZR	91	5.49E+02	CS	137	8.16E+00	AM	241	5.57E+02
ZR	92	5.95E+02	BA	134	1.60E+02	AM	242M	1.72E+00
ZR	93	6.69E+02	BA	136	2.00E+01	AM	243	9.49E+01
ZR	94	6.92E+02	BA	137	3.35E+02	CM	244	1.82E+01
ZR	96	7.45E+02	BA	138	1.19E+03	CM	245	1.08E+00
MO	92	1.23E+00	LA	139	1.13E+03			
MO	95	6.87E+02	CE	140	1.15E+03			
MO	96	3.78E+01	CE	142	1.05E+03			
MO	97	7.24E+02	PR	141	1.04E+03			
MO	98	7.46E+02	ND	142	2.59E+01			
MO	100	8.52E+02	ND	143	7.16E+02			
TC	98	4.45E-03	ND	144	1.24E+03			
TC	99	7.06E+02	ND	145	6.22E+02			
RU	100	9.73E+01	ND	146	6.44E+02			
RU	101	7.04E+02	ND	148	3.44E+02			
RU	102	7.08E+02	ND	150	1.65E+02			
RU	104	4.98E+02	PM	147	3.82E+00			
RH	103	4.10E+02						
						<b>TOTAL</b>		1.00E+06

2.

	FEMAXI-IV		MARS	
	( )	( )	( )	( )
48.9 kW/m	2114	84	2251	79

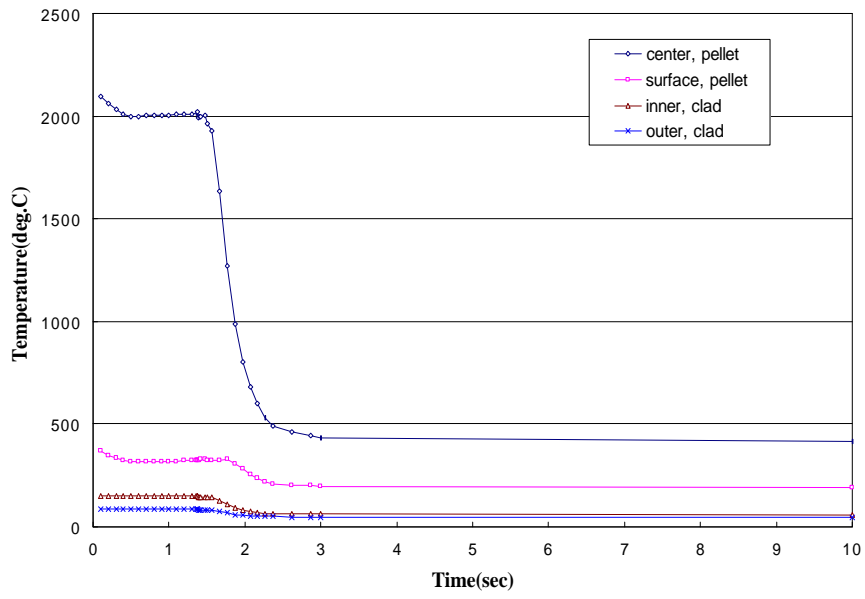


1. DUPIC

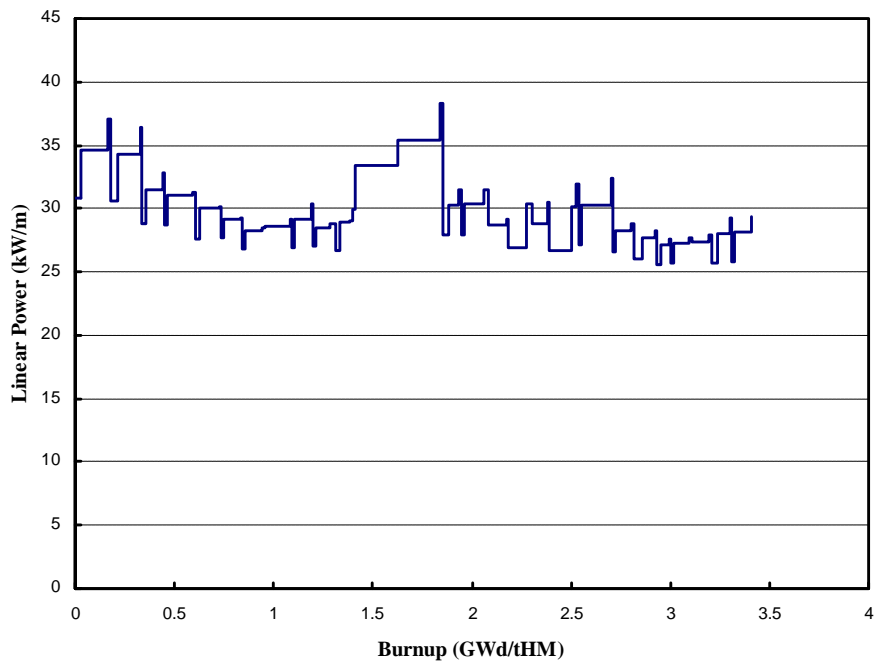


2. FEMAXI -IV

RIA



### 3. FEMAXI-IV



### 4. DUPIC

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