

DUPIC 가

Evaluation of Irradiation Behaviour of DUPIC Pellets Using the HANARO

, , , , ,
305-353 150

DUPIC

. 2
59.12 kW/m , DUPIC 1,770 MWd/tU 가 .
PIEF ,
DUPIC

Abstract

The irradiation test of DUPIC pellets in the HANARO was carried out to estimate their in-pile behaviour and performance . For the irradiation period of 2 months, the maximum linear power calculated from the operational data of the HANARO was 59.12 kW/m, and the estimated average burnup of DUPIC pellets was 1,770 MWd/tU. These irradiated mini-elements were transported to the PIEF so that the post irradiation examinations such as metallography and γ -scanning was performed. The qualitative irradiation behaviour of DUPIC pellets in the HANARO can be estimated from the burnup history and the results of post irradiation examinations.

1.

1.5 wt% ,
0.711 wt% U-235 .

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

가

[1]. , 가

DUPIC .

DUPIC ,

[2]. 1993
DUPIC
DUPIC OREOX (Oxidation and Reduction of Oxide Fuel)
DUPIC
[3].
DUPIC AECL Whit Shell Lab. BWR
3 DUPIC, 1 NRU
1999 3 12 . , 1999 5 7 2
2
21,000 MWd/tHM [4]. , DUPIC
1999 8 4 1999 10 4 2 DUPIC 1
. DUPIC
DUPIC , DUPIC
[5].
DUPIC
DUPIC
, DUPIC

2. DUPIC

DUPIC
DFDF(IMEF M6 Hot Cell) . 1986 1
PIEF G23 G2 .
.

- 14 x 14
- : 179
- : 3.21% U-235
- (): 35,502 MWd/tU (4 ~ 7)
- : 1986. 10. 24.

ORIGEN-2
DUPIC
[6]. DUPIC OR4
. , ORIGEN-2
.
, DUPIC ,
, 1 [7, 8].
DUPIC DUPIC
가 DUPIC

1.		DUPIC			(: g)		
O	16	1.43E+05	CD 112	6.22E+00	GD 154	2.91E+01	
O	18	3.29E+02	CD 113	3.98E-02	GD 155	1.23E+01	
			CD 114	8.85E+00	GD 156	7.19E+01	
SR	88	3.90E+02	CD 116	2.73E+00	GD 157	1.12E-01	
SR	90	4.31E+02			GD 158	2.15E+01	
			BA 134	1.92E+02	GD 160	2.01E+00	
Y	89	5.09E+02	BA 137	4.02E+02			
			BA 138	1.43E+03	U 234	1.62E+02	
ZR	90	1.87E+02			U 235	5.91E+03	
ZR	91	6.58E+02	LA 139	1.21E+03	U 236	2.71E+03	
ZR	92	7.14E+02			U 238	8.12E+05	
ZR	93	8.02E+02	CE 140	1.38E+03			
ZR	94	8.30E+02	CE 142	1.26E+03	NP 237	5.52E+02	
ZR	96	8.94E+02					
			PR 141	1.25E+03	PU 238	1.85E+02	
MO	95	8.25E+02			PU 239	4.77E+03	
MO	97	8.68E+02	ND 143	6.87E+02	PU 240	2.22E+03	
MO	98	8.95E+02	ND 144	1.19E+03	PU 241	6.68E+02	
MO	100	1.02E+03	ND 145	5.97E+02	PU 242	5.75E+02	
			ND 146	6.17E+02			
TC	99	8.47E+02	ND 148	3.30E+02	AM 241	6.68E+02	
			ND 150	1.58E+02	AM 242M	2.06E+00	
RU	101	8.44E+02			AM 243	1.14E+02	
RU	102	8.49E+02	SM 147	1.52E+02			
RU	104	5.97E+02	SM 148	1.39E+02	CM 244	2.18E+01	
			SM 149	2.43E+00	CM 245	1.30E+00	
RH	103	4.92E+02	SM 150	2.30E+02			
			SM 151	9.43E+00			
PD	104	2.78E+02	SM 152	9.80E+01			
PD	105	4.30E+02					
PD	106	4.03E+02	EU 151	1.24E+00			
PD	107	2.48E+02	EU 152	2.10E-02			
PD	108	1.71E+02	EU 153	1.15E+02			
			EU 154	1.17E+01	U total	8.21E+05	
CD	110	1.11E+01	EU 155	1.99E+00			
CD	111	8.57E+00			TOTAL	1.00E+06	

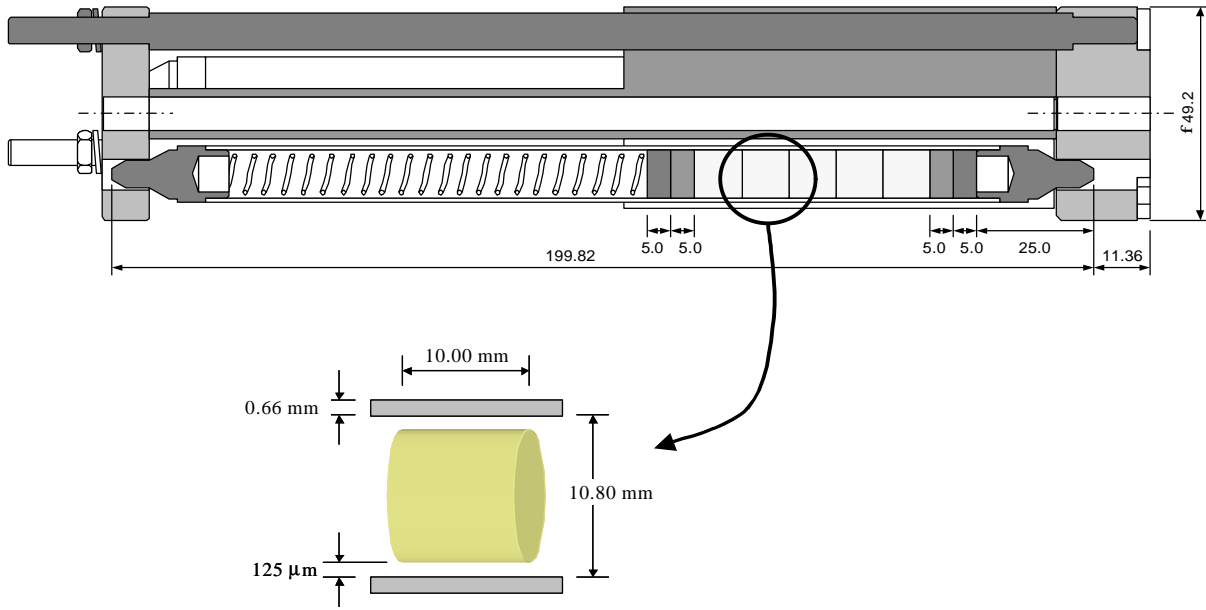
* La, Nd, Sm, Eu, U, Pu:

* CD-113, SM-151, EU-152 and GD-157 shows a very low concentration, but very large C.X.

가 [9]. , U-235 DUPIC
 가 , G23-G2

3.

2000 5 10 2 OR4 2 DUPIC
 . 1999 DUPIC
 DUPIC , 가 .
 DUPIC DUPIC
 (1).
 DUPIC [10].

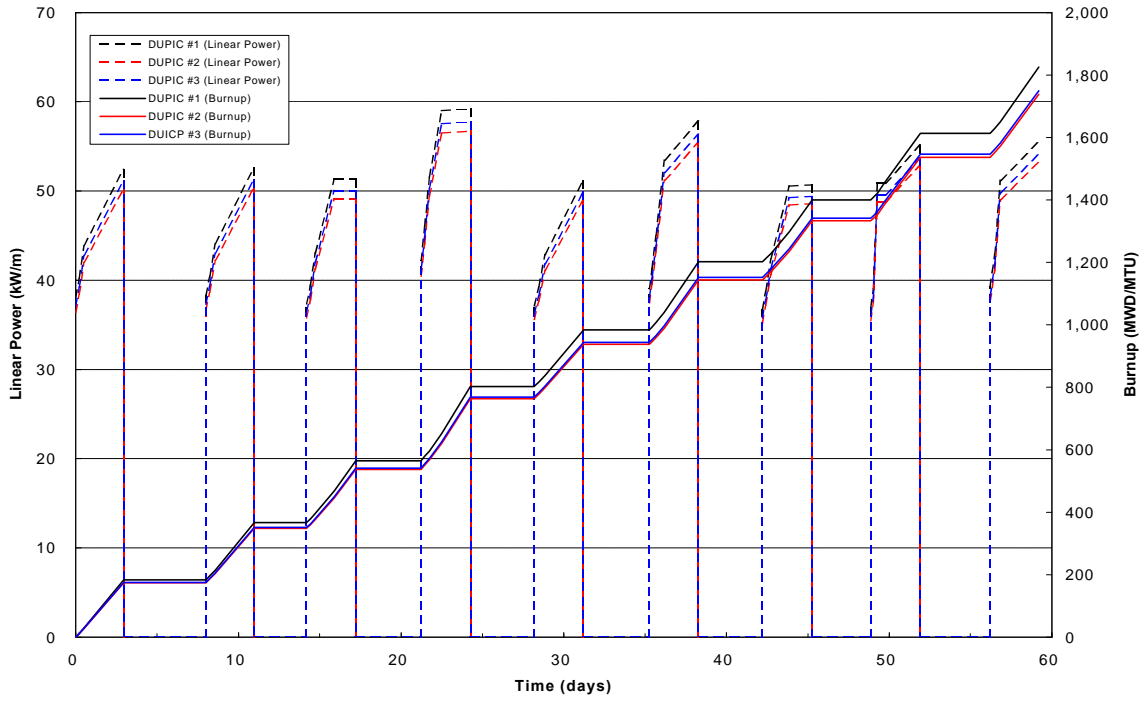


1. DUPIC

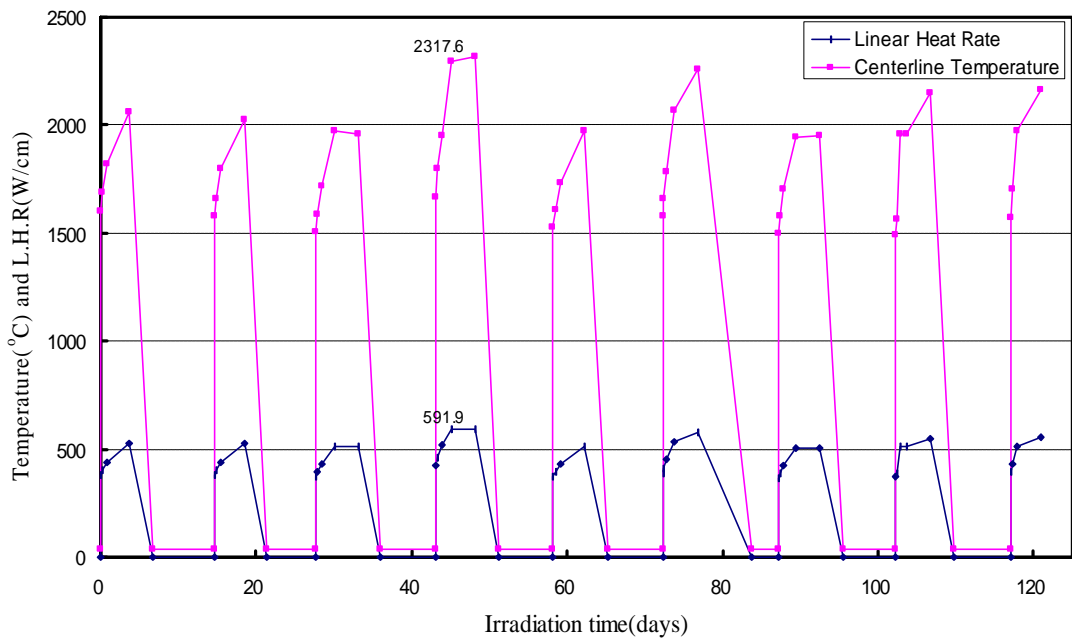
DUPIC 22MW
 OR4 DUPIC
 MCNP , VENTURE
 . DUPIC
 FEMAXI-IV [11]. , DUPIC
 RIA , HEATING
 DUPIC ORIGIN
 2 . 59.12 kW/m , DUPIC
 #1, #2, #3 1820 MWd/tU, 1730 MWd/tU, 1740 MWd/tU 가 .
 , FEMAXI-IV DUPIC ,
 2320 °C (3).

4.

DUPIC 30 IMEF
 ORIGIN-2 DUPIC
 (2). ,
 DUPIC IMEF .



2. OR4 DUPIC



3. DUPIC

2. DUPIC

CONCENTRATION (Unit: Grams)

Decay (days)	0	1	7	15	30	60	90	180
A.P.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Act.	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02	1.05E+02
F.P.	3.48E+00	3.48E+00	3.48E+00	3.48E+00	3.48E+00	3.48E+00	3.48E+00	3.48E+00
Total	1.09E+02	1.09E+02	1.09E+02	1.09E+02	1.09E+02	1.09E+02	1.09E+02	1.09E+02

RADIOACTIVITY (Unit: Ci)

Decay (days)	0	1	7	15	30	60	90	180
A.P.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Act.	5.95E+03	1.87E+03	3.62E+02	8.33E+01	4.35E+01	3.73E+01	3.46E+01	2.85E+01
F.P.	2.37E+04	2.76E+03	1.14E+03	7.58E+02	4.92E+02	2.93E+02	2.06E+02	9.88E+01
Total	2.97E+04	4.63E+03	1.51E+03	8.41E+02	5.35E+02	3.30E+02	2.40E+02	1.27E+02

THERMAL POWER (Unit: Watts)

Decay (days)	0	1	7	15	30	60	90	180
A.P.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Act.	1.59E+01	5.41E+00	1.78E+00	1.07E+00	9.29E-01	8.17E-01	7.25E-01	5.08E-01
F.P.	3.03E+02	1.26E+01	5.02E+00	3.23E+00	1.94E+00	1.07E+00	7.50E-01	3.85E-01
Total	3.19E+02	1.80E+01	6.80E+00	4.30E+00	2.87E+00	1.88E+00	1.47E+00	8.93E-01

Radioactivity Limit: 3.06E+05 Ci

Thermal Power Limit: 1.30E+03 W

IMEF

DUPIC

PIEF

8, 400 (4).

0.94 mm, 가 (4) 1) 27

µm x 150 µm 가, (4) 3) 8.3 µm

가 . 가

5.6 µm 가 .

1700 ~ 2150 °C

[12],

DUPIC

DUPIC, .

가, .

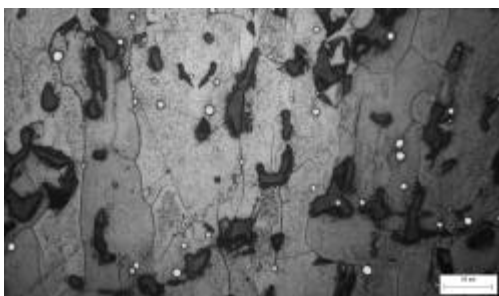
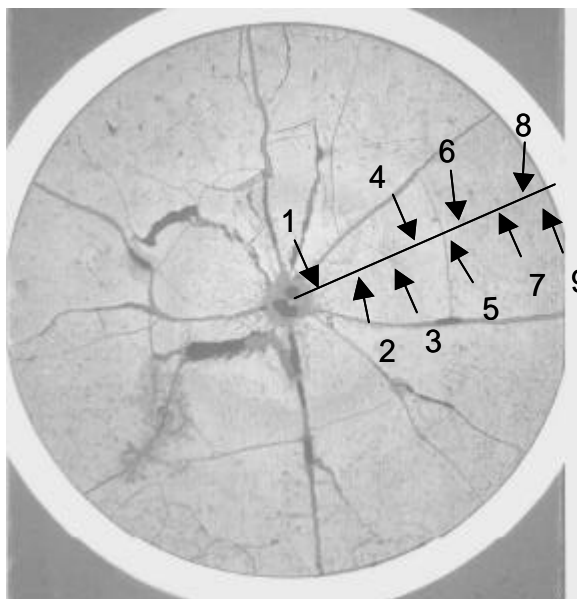
2001 3 DUPIC

5.

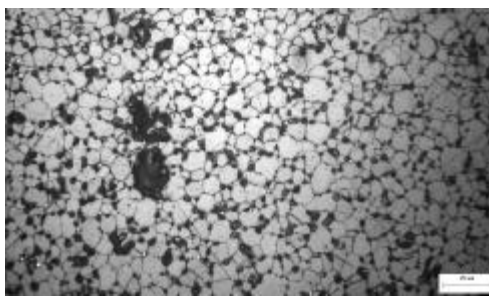
DUPIC 가 35000 MWd/tU 가

DUPIC, .

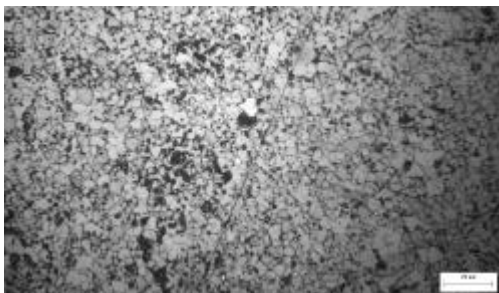
DUPIC 가, DUPIC



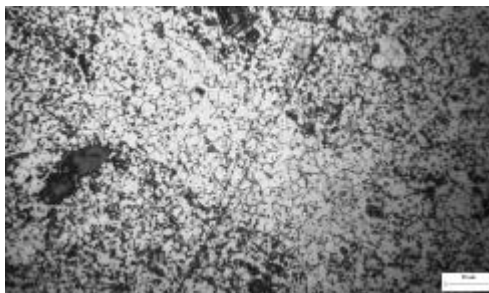
(1) 400X



(3) 400X



(6) 400X



(9) 400X

4. DUPIC

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