MC^2-2

Comparison of Heterogeneous Effect on KALIMER Fuel Cell with the MC^2-2 Code

,   ,   ,   ,   ,

150

KALIMER

MC2-2/ONEDANT   TRANSX/ONEDANT   MCNP

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,

.

Bell   .

Abstract

Criticality calculations for two types of cell models based on the KALIMER driver fuel; a pin cell and an assembly cell model, were performed with MC^2-2/ONEDANT, TRANSX/ONEDANT code systems and MCNP code. The result shows that the heterogeneous effect on an assembly cell is larger than that on a fuel pin cell and the heterogeneous effect should be counted to enhance the calculation accuracy. Also we found that the proper Bell factor representing neutron escape probability from the fuel is prerequisite to consider the heterogeneous effect more precisely.

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(cell)

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1

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.   ,

, Dancoff

.   Dancoff

Bell   . Dancoff   Bell

,   Dancoff

,

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KALIMER   TRANSX   .

150   .

TRANSX

MC^2-2   .   MC^2-2   TRANSX

MCNP   MC^2-

2   Bell   ,

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2   K-CORE

2.1   TRANSX

K-CORE   TRANSX/

TWODANT   . TRANSX   KAFAX-E66

KAFAX-F22   MATXS   . KAFAX-E66

ENDF/B-VI Release 6   NJOY99   150   12

, KAFAX-F22   JEF-2.2   80

.

TRANSX   . KAFAX
TRANSX   MATXS   ISOTXS   TWODANT
                          , TWODANT   RZFLUX
         .   9 25   ,
TWODANT   TRANSX   KAFAX
                DIF3D   REBUS3
         .

2.2   MC^2-2

MC^2-2   8   (MCC2F1~MCC2F8)   ,
    ENDF/B-V   ETOE-2   . MC^2-2
    ARC   XS.ISO   CCCC   ISOTXS   . MC^2-2   2082
                                          , TRANSX
                                    .
                              .

MC^2-2   .

1)   (CSI010)
2)   (CSC004)
3)   (CSC005)
4)   -   (CSC006)
5)   UFG(Ultra- Fine- Group)   ,   ,
        (CSC008)
6)   UFG   ,   , BG(Broad
        Group)   (CSC009)
7)   BG   ,   (CSC010)
8)   HFG (Hyper- Fine- Group)
        (CSC011)
9)   ISOTXS   (CSE009)
10)   ISOTXS   ARC   XS.ISO   (CSE007)
11)   XS.ISO   (CSE012)

3

3.1

                                        (20) KALIMER 150MWe breakeven

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MC²-2/ONEDANT　　　　　　　　　　TRANSX/

ONEDANT　　MCNP　　　　　　　. TRANSX

, MC²-2　　　　　　　　　　　　　　　　　　　　　　. TRANSX

　　　　　150　　　　　　　　KAFAX-E66　　　　80

, MC²-2　　　　　　　　2082　　RABANL　　　　　　80

　　　.

　　　　　　MC²-2　TRANSX　　　　　　　　0　　　　.

(transport approximation)　　consistent-P1 approximation

.　　　　　ONEDANT　　　　　　　, ONEDANT

　　　　　.

3.2

　　　　1　　　　　　　　　　　　　　　　　　,

,　　　　　　3　　　　　　　,　　　　　　　　　.

A.MCC2 14　　13-24

　　　　　.　　　　Bell

,　　　　　　　　(　　　　　　1.95, 2.95,

1.60)　　.

2　　　　　　　　　　　(Δk)　　　　. MC²-2

Δk　　　　　300keV

. 300keV~400keV

. MCNP　　　　　, Δk　0.00094　400keV

,　　　　　　　400keV

,

. MC²-2

MCNP　　　　　　　　　　TRANSX

MCNP　　　.　　TRANSX　ENDF-B VI

, MC²-2　ENDF/B-V

.　　,　　　　　　　　　　　　　,

.

3.3

271

(10   )   (10   )   ,

22   .

400keV

.   Bell

.

3   Bell

MC^2-2   (1.95, 2.95,   1.60)

MCNP   . 2~4   7

1.35   +   1.6, 3.0, 1.0, 0.5

.   ,   +   Bell Δk Bell

3.0 Δk . 4~6

+   1.00   1.35, 1.0,

0.5   .   ,   Bell Δk

. 8~10   Bell   1.0

+   0.4, 0.3, 0.2   .   +   Bell

Δk , Bell   0.4, 0.3   MCNP

Δk .   Bell

.

4

KALIMER 150MWe Breakeven

. MC^2-2/ONEDANT   TRANSX/ONEDANT

, MCNP   .

(Δk)   .   400keV

MCNP Δk .

, Bell

.   Bell

.   Bell

Δk ,

Bell Δk .

Δk 0.00094 ,

0.00353 .

,

.

Bell .

Bell

.

, MCNP

Bell .

Bell

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MC^2-2/ONEDANT

MC^2-2

. ONEDANT RZFLUX MC^2-2

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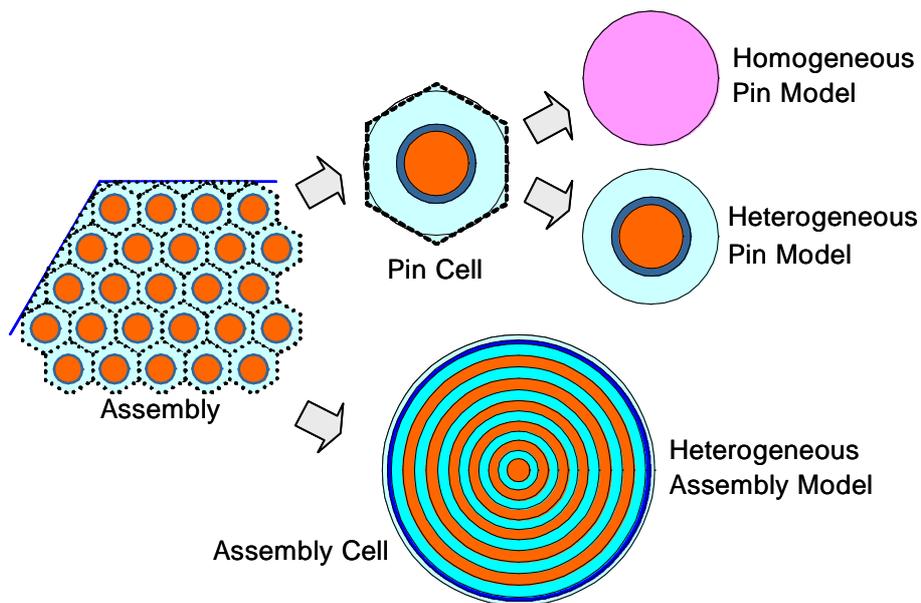
1 KALIMER

ASSEMBLY DATA

Number of Pins per Assemby	271
Fuel smeared density (%)	75.0%
Duct Material	HT9
Duct Wall Thickness (cm)	0.37
Duct Outer Flat to Flat (cm)	15.7
Duct Inner Flat to Flat (cm)	14.96
Active Length (cm)	100.00
Fuel Element Length (cm)	346.68
Gap Distance between Ducts (cm)	0.40
Assembly Lattice Pitch (cm)	16.10
Assembly Area (cm^2)	224.482

PIN DATA

Fuel Type	U-Pu-10%Zr
Fuel Fabrication Density (%TD)	100.0
Cladding Material	HT9
Pin Overall Length (cm)	346.8
Pin Outer Diameter (cm)	0.74
Pin Inner Diameter (cm)	0.63
Cladding Thickness (cm)	0.055
Fuel Slug Diameter (cm)	0.546
Fuel Cladding Gap (cm)	0.042
Pin Pitch (cm)	0.89
Pin P/D Ration	1.203
Wire Wrap Diameter (cm)	0.14
Wire Wrap Pitch (cm)	20.49
Bond	Na

2

Code	Energy (keV)	Pin Hetero. Model	Pin Homo. Model	Δk
MC^2-2	1400	1.78854	1.78602	0.00252
	500	1.79554	1.79468	0.00086
	400	**1.79811**	**1.79716**	**0.00095**
	300	**1.80031**	**1.79935**	**0.00096**
	200	1.80221	1.80134	0.00087
	100	1.80342	1.80270	0.00072
	50	1.80418	1.80360	0.00058
	9	1.80417	1.80397	0.00020
MCNP	-	1.81588± 0.00058	1.81494± 0.00058	0.00094
TRANSX	-	-	1.81921	-

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Code	Bell factor	Assembly Hetero. Model	Assembly Homo. Model	Δk
MC^2-2	1.95, 2.95, 1.60, ... (default)	1.71090	1.71034	0.00056
	1.35, 1.60, ...	1.71092	"	0.00058
	1.35, 3.00, ...	1.70955	"	-0.00079
	1.35, 1.00, ...	1.71185	"	0.00151
	1.00, 1.00, ...	1.71186	"	0.00152
	0.50, 1.00, ...	1.71186	"	0.00152
	1.35, 0.50, ...	1.71314	"	0.00280
	1.00, 0.40, ...	**1.71350**	**"**	**0.00316**
	1.00, 0.30, ...	**1.71391**	**"**	**0.00357**
	1.00, 0.20, ...	1.71435	"	0.00401
MCNP	-	1.73358± 0.00055	1.73005± 0.00052	0.00353
TRANSX	-	-	1.81921	-