

Core Thermal Hydraulic Characteristics of Open Pool Type Research Reactors

Hyung Min Son*, Kiwon Song, Jonghark Park

Korea Atomic Energy Research Institute, 989-111 Daedeok Daero, Yuseong Gu, Daejeon, 305-353, Korea

*Corresponding author: hyungmson@kaeri.re.kr

Introduction

- KAERI is designing an integrated thermal hydraulic test loop for studying heat and flow characteristics in RR core cooling channel.
- Facility aims to generate TH data on narrow rectangular cooling channel in open pool-type RR.
- This study compiled and analyzed core TH conditions of RRs with medium thermal powers (≥ 5 MW).

Core TH Design Summary

- RR have similar inlet temperature ranges, but have widely scattered distributions in terms of inlet pressure, coolant velocity, and heat fluxes.
- Core coolant flow direction plays crucial role in core subcooling range.

Table I: Core thermal hydraulic design variables of medium and higher power research reactors

Parameter	Research Reactor								
	JRTR	KJRR	JRR-3M	OPAL	TRR-II	ETR-2	RMB	RA-10	RGS-GAS
Q_{core} [MW]	5	15	20	20	20	22	30	30	30
T_{in} [$^{\circ}$ C]	37	35	35	38	40	40	38	38	40
P_{in} [kPa]	180	180	155	370	152	280	490	557	199.7
dP_{core} [kPa]	22	95	110	200	52	80	300	360	50
V_{ch} [m/s]	2.5	6	6.2	8.2	6.24	4.7	9.4	11.5	3.8
Direction	Down	Down	Down	Up	Up	Up	Up	Up	Up
No. FAs	18	22	26/6	16	25/6	29	23	19	40/8
No. Plates/FA	21	21	19/15	21	21/17	19	21	21	21/15
t_{ch} [mm]	2.35	2.35	2.28/2.38	2.45	2.58	2.7	2.45	2.45	2.55
W_{ch} [mm]	66.6	66.6	66.6/54.0	70.5	71.5	70	70.5	70.5	67.1
W_{meat} [mm]	62.1	62	62/49	65	67.3	64	65	65	62.75
L_{meat} [mm]	640	600	750	615	600	800	615	615	600
q_{avg} [kW/m 2]	158	414.6	380.2	720	409	370.4	738	940	394.3
F_{cl} [-]	≤ 3.0	≤ 3.0	3.112	≤ 3.0	3.829	3.16	≤ 3.0	3.3	5.62

- Comparing coolant velocities to fuel heat fluxes may be more intuitive than just looking at core powers, where overall proportional relationship is observed.

