CENTRAL EXPERIMENTAL CHANNEL RADIATION CHARACTERISTICS OF THE PIK REACTOR

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The high flux PIK reactor [1—3] is constructed for fundamental and applied physical research. The thermal flux density maximum is reached in the central experimental channel (CEC).

The thermal and fast flux densities and the energy release in structural materials have been measured by the activation method and with the Gray ionization chambers on the physical model (FM) of the PIK reactor. The power of X-ray dose has been measured with thermoluminescence dosimeters. The power of the FM has been measured by means of two independent methods [4]. The thermal and fast flux densities, the fast neutron spectrum ,the energy release in structural materials and in light water has been measured as well as calculated by DOT-3.5, MCU, TAY codes.

Table 1

Flux densities (10^{12} $n/cm^2 \cdot s \cdot MW$), energy release (10^{-2} $W/g \cdot MW$), and power of X-ray dose (10^3 $R/s \cdot MW$) in CEC, in core and in reflector of the PIK reactor

	CEC water	CEC dry Al channel	Middle part of the core dry Al channel	Reflector heavy water	Reflector the GEC-4 aluminum channel
R *mm*	0	0	10.8	330	480
Z *mm*	0	0	0	0	15
Φ_0	34.4	31.6	2.2 [3]	9	4.7
Φ_t	42	38.5		11	5.7
$\Phi_{t,calc}$	42			10.4	
$\Phi_{1,2}$	5.0		8 [3]		0.053
$\Phi_{1.2,cal}$	5.1				0.025*
q_c		42	40		1.8
$q(H_2o)$	105				
$q(^{235}U)$	1.5×10^5		6×10^3	43×10^3	24×10^3

*) unperturbed flux

Table 2

Reactivity effects for loading of samples in the CEC

N	Loading in CEC	Coolant	$\nabla_\rho(\beta_{eff})$
1.	Empty channel	water	0
		air	+1.1 — 0.1
2.	Stainless steel tube	water	-0.7 — 0.2
		air	+0.3 — 0.2
3.	Aluminum rod	water	+0.2 — 0.1
4.	Cadmium cylinder δ=0.6	water	-2.7 — 0.3
5.	Fuel element with		
	fuel quantity "1"	water	+0.52 —0.05
	fuel ; quantuty "1/3"	water	+0.22 — 0.05

The radiation characteristics in the CEC and as well as in the core and in the reflector are shown in table 1. The thermal flux density maximum in the CEC for central control device out of the core and for the PIK reactor metal/water ratio 0.2 is equal to 4.2×10^{13} $n/cm^2\cdot s\cdot MW$). The maximum specific activity of thin ^{50}Cr sample are reached 6.10 decays/$(s\cdot g\cdot MW)$ [5] for 100 days irradiation in the CEC.

The reactivity effects for loading different samples in the CEC in light water with regard to initial condition without samples have been measured. The sample height was 500 *mm*. The distances between absorbing ends of the central control device were equal to 215 *mm*. The obtained results enable to choose the safety samples removing regimes on operating reactor to determinate the rate of the samples removing and its dimensions.

The cooling system is able to lead away up to 200 *kW* of heat from structural materials and water and up to 200 *kW* of heat from irradiated samples. It is also poddible to load and to unload samples on operating reactor without shut-down.

References

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