AXIAL DISTRIBUTION OF ABSORBED DOSES IN FAST NEUTRON FIELD AT THE RB REACTOR

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ABSTRACT

The coupled fast thermal system CFTS at the RB reactor is created for obtaining fast neutron fields. The axial distribution of fast neutron flux density in its second configuration (CFTS-2) is measured. The axial distribution of absorbed doses is computed on the basis of mentioned experimental results. At the end these experimental and computed results are given.

KEYWORDS

Coupled fast - thermal system, RB reactor, fast neutron fields, axial distribution, activation technique, fast neutron flux density, sulphur pellets, absorbed doses.

INTRODUCTION

The RB is a zero power nuclear facility in the Boris Kidrič Institute of Nuclear Sciences (Popović, 1958.). It is possible to create the fast neutron fields by 80% enriched uranium fuel elements. The possibilities to obtain different neutron spectra are investigated using the converter and additional nonfissionable screens (Strugar et al, 1981.). The modified experimental fuel channel EFC (Pešić et al, 1984.) and convertors of neutrons inside the RB reactor CFTS-1 and CFTS-2 were created in continuing of this investigation (Pešić, 1984.). The devices give well defined neutron and gamma fields.

COUPLED FAST-THERMAL SYSTEM No.2-CFTS-2

The fast core of CFTS-2 is formed of natural metal uranium fuel elements. The central area of the fast core is an air field cylindrical experimental space with diameter of 300 mm and height up to 120 cm. The thermal RB core (driver) has a standard RB lattice pitch of 12 cm of 2% enriched metal uranium and 80% enriched UO_2 fuel elements in D_2O moderator. The configuration of RB core with CFTS-2 is shown in Fig.1. The cross section of fast core of CFTS-2 is shown in Fig.2.

AXIAL DISTRIBUTION OF FAST NEUTRON FLUX - DENSITY

The axial distribution of fast neutron flux density is measured by acivation technique (M.Šokčić-Kostić et al, 1986.[a]). The sulphur pellets as threshold detectors are used in this measurements. Foil activities are measured using $4\pi\beta$ absolute counting method. The measuring results were treated with ACT program. It is based on analytical relations accounting for all necessary physical and geometrical corrections. This program returns foil saturated activity and neutron flux density.

AXIAL DISTRIBUTIONS OF ABSORBED DOSES

The neutron spectrum in the air hole of CFTS-2 is calculated by VESNA code (Milošević, private comunication) in 44 energy groups. Using absolute neutron flux density measurements with sulphur pellets, neutron spectrum is normalized in 44 energy groups and condensed in one macrogroup above 2 MeV. The axial distribution of absorbed doses in CFTS-2 is determined with ADOS program based on analytical relations using absorbed dose - neutron flux density conversion factors (M.Šokčić-Kostić et al, 1986.[b]). The results together with axial distribution of fast neutron flux density are given in Table 1. The axial distribution of neutron absorbed doses in CFTS-2 are shown in Fig.3.

TABLE 1. Axial distribution of fast neutron flux density and absorbed doses in CFTS-2

H (cm)	ϕ(n/cm^2/s/W)	Dafast (Gy/Wh)
15	$(4.92 \pm 0.18)\times10^5$	0.074
30	$(6.80 \pm 0.25)\times10^5$	0.102
46	$(8.80 \pm 0.32)\times10^5$	0.132
60	$(8.79 \pm 0.32)\times10^5$	0.132
75	$(8.67 \pm 0.31)\times10^5$	0.130
90	$(7.37 \pm 0.27)\times10^5$	0.110
112	$(4.32 \pm 0.16)\times10^5$	0.065
122	$(3.13 \pm 0.12)\times10^5$	0.047

CONCLUSION

The axial distribution of absorbed doses in CFTS-2 is determined by using the axial distribution of fast neutron flux density and ADOS program.

The investigation of fast neutron fields at the RB reactor will be continued. Gamma absorbed doses will be also determined.

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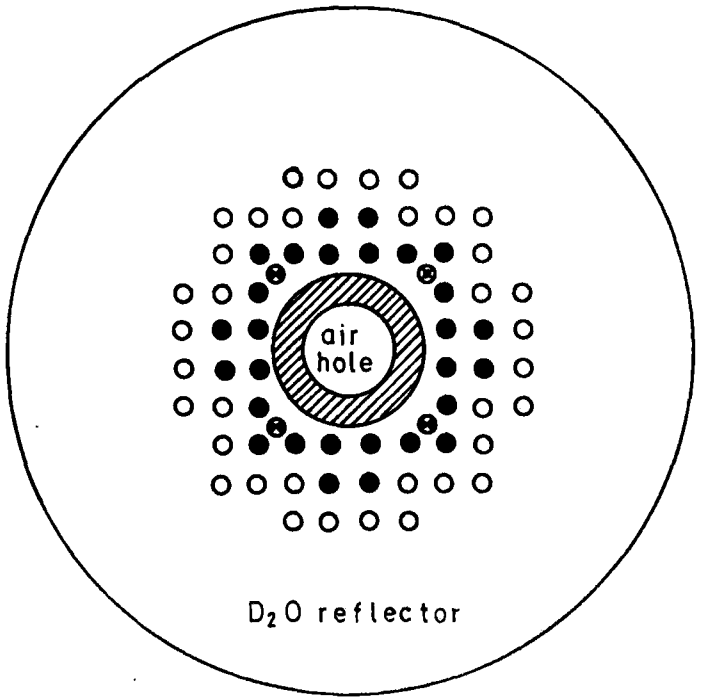


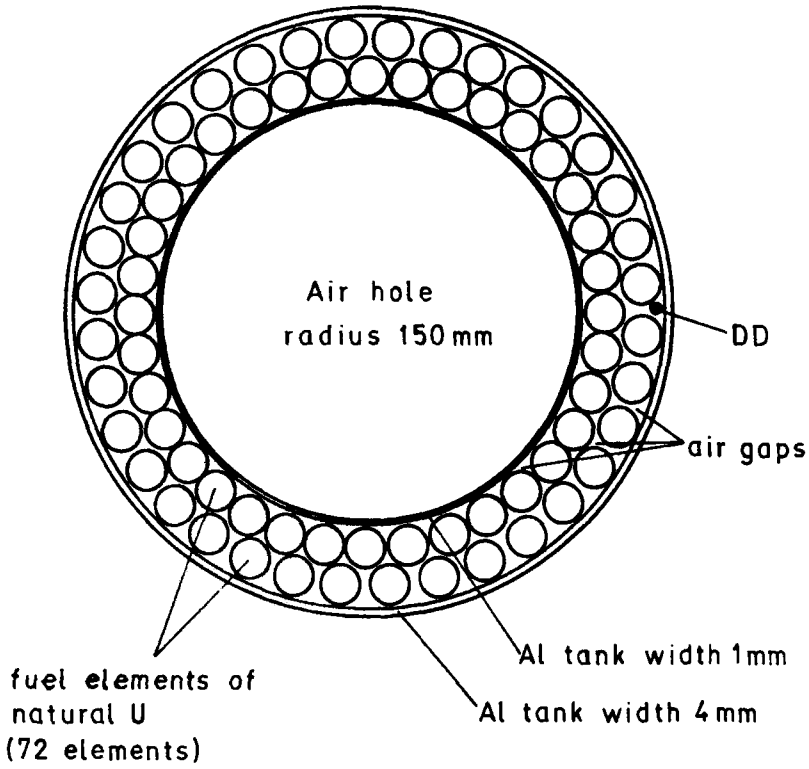
Fast core of CFTS-2

72 fuel elements of natural U

Thermal core lattice pitch of 12 cm

- 28 fuel channels of 80% enriched UO_2
- 36 fuel channels of 2 % enriched U
- safety rods
- control rod

Fig. 1. Configuration of RB core with CFTS-2



DD - D_2O filling detector connected in RB safety system

Fig. 2. Cross section of fast core of CFTS-2

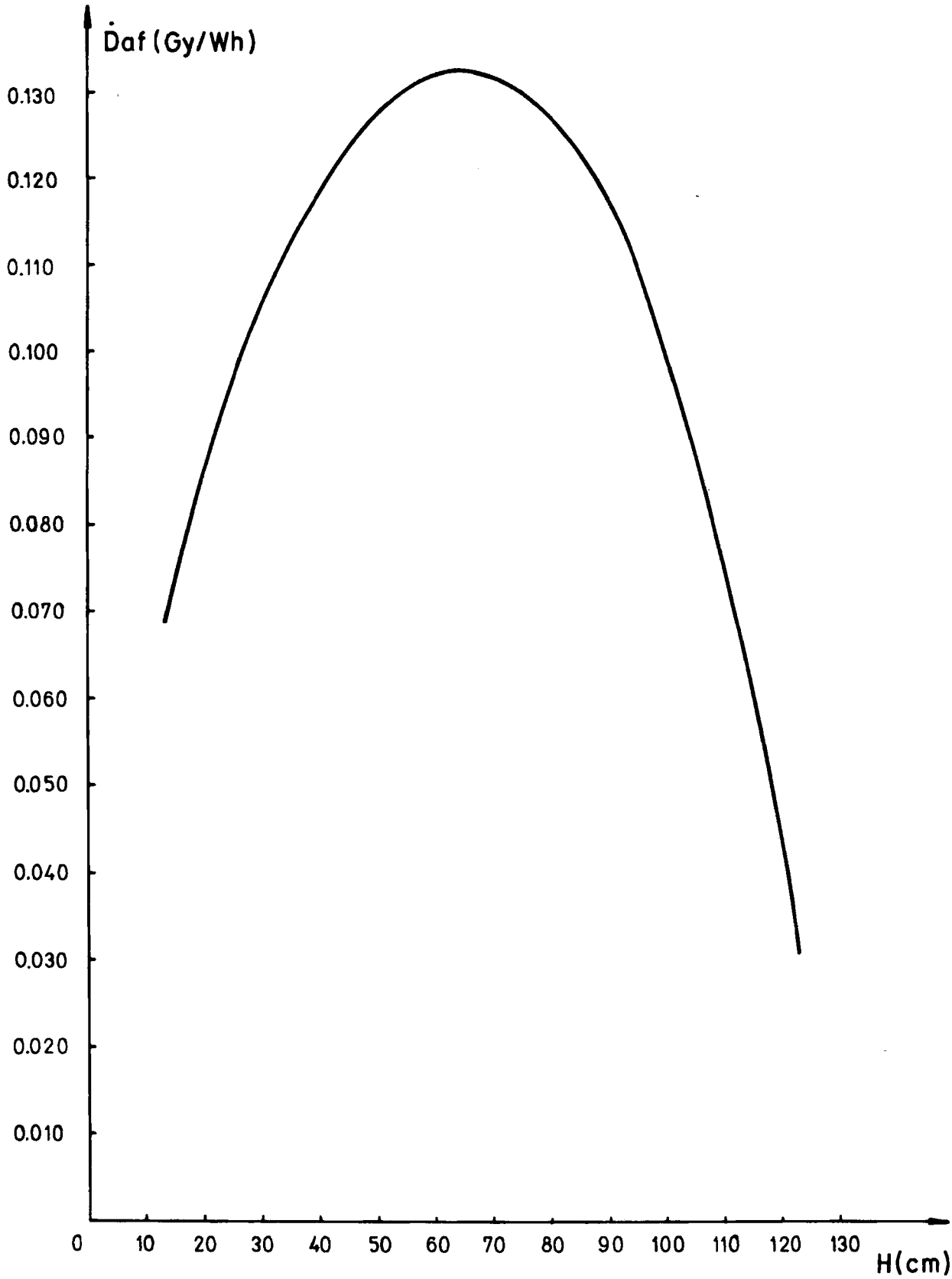


Fig.3. Axial distribution of neutron absorbed doses in CFTS-2

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