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INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

PROGRESS REPORT 1969

FROM BULGARIA TO THE INDC

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Progress Report

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Several groups are working on structure of nuclei obtained at the reactor IRT-1000 in Sofia, or by using some accelerators abroad, and also on practical applications of the reactor such as activation analysis. Their subjects do not seem to be related to the INDC interests and therefore will not be considered here.

1. A group (N. Kashukeev et al.) is developing a programme of photo-fission studies of heavy nuclei ^{238}U, ^{239}Pu, ^{232}Th after irradiation with monoenergetic gamma-rays of various energies, obtained at the reactor by means of (n, γ) reactions. Energy, mass and angular distributions of fission products will be studied. The measurements are correlated, i.e. the three pulses from a double pulse ionization chamber, giving both fragment energies and the angle, are registered. Electronic computer data processing is used.

Until now - preliminary measurements of fission after neutron irradiation have been performed. Energy and mass spectra have been obtained. Fragment ranges in the chamber gas, necessary for the data processing, have been studied.

2. A group (V. Hristov et al.) is working in the field of neutron constants for heterogeneous media safeguards. Two methods are being applied: the exponential method, and the removal cross-section method. Analytic and numerical calculations for these media are being performed. Their data, the authors hope, will appear in the autumn, and about that time the group might be able to say something about their data needs as well.

3. A four-group integral algorithm for criticality calculation, and a four-group algorithm for burn-up calculation of heterogeneous U - H_2O reactors have been developed. Programmes in Algol-60 are available and might be obtained on request.

4. A group (V. Hristov et al.) is working on neutron diffusion parameters for heterogeneous water lattices by pulse methods, using a fast chopper, at the IRT - 1000 reactor in Sofia. This is a development of some measurements mentioned in my letters to the IAEA Nuclear Data Unit of 24.4. and 24.9.1969. The lattices

consist of light water with empty cylindrical aluminium tubes (lattice spacing 1.8 cm and tube radius 0.5 and 0.7 cm). Table 1 shows the results.

Table 1

Lattice type	$v\Sigma_a$ cm^{-1}	$D_{\parallel}$ cm^2.s^{-1}	$D_{\perp}$ cm^2.s^{-1}	$\tilde{C} \approx C_{\parallel} \approx C_{\perp}$ cm^4.s^{-1}
R=0.5 cm	3779 ± 76	58682 ± 870	49810 ± 750	17664 ± 2700
R=0.7 cm	2962 ± 60	86990 ± 1280	75769 ±1100	57806 ± 8700

Table 2 gives a comparison with the theories of Behrens D.I. (Proc. Phys. Soc. A 62, 607, 1949) and Stepanov A. (Neutron Thermalization and Reactor Spectra, vol.I, p.193, IAEA Vienna, 1968), and also with a formula introduced by Hristov V. (Thesis, Sofia, 1969).

Table 2

	R=0.5 cm		R=0.7 cm	
	Experiment	Theory	Experiment	Theory
$D_{\parallel}/D_o$	1.489	1.587 Behrens	2.149	2.417 Behrens
$D_{\perp}/D_o$	1.264	1.384 Behrens	1.884	1.882 Behrens
$\tilde{C}/C_o$	3.205	2.632 Hristov	9.618	7.00 Hristov
$D_{\parallel}/D_{\perp}$	1.178	1.136 Behrens 1.181 Stepanov	1.147	1.284 Behrens 1.261 Stepanov

The experimental values of $D_{\parallel}/D_o$ and $D_{\perp}/D_o$ are lower than the theoretical ones, as observed for graphite and organic glass by other authors. The measured values of $\tilde{C}/C_o$ are in good agreement with the calculated ones.

Now the neutrons thermalization in these lattices is being investigated by the Friedman method, by means of moderator poisoning with a non- 1/V absorber.

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