USAEC - AECL COOPERATIVE PROGRAM

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Technical Information Service

This document is furnished pursuant to the memorandum of understanding of June 7, 1960, between the U. S. and Canadian Governments establishing a Cooperative Program on the development of heavy water moderated power reactors.

E. I. du Pont de Nemours and Co.
Savannah River Laboratory
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SECTION I

PHYSICS EXPERIMENTS FOR CANDU LATTICES

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INTRODUCTION

New experiments are being prepared for the measurement of the change of η with temperature in a natural uranium lattice in the PDP. Analyses of previous experiments are still underway.

SUMMARY

Calculations indicate that the experiments measuring the variation of η with temperature should have an error of less than ±13%. Buckling measurements on simulated burned-up fuel were reduced to a common basis in the exponential and critical experiments.

DISCUSSION

Variation of η with Temperature

The $\delta\eta/\delta T$ experiment will be performed in the PDP in June 1967. A temperature interval from 20° to 60°C will be covered. As discussed in previous reports, the fuel will consist of 1-inch-diameter natural uranium rods housed in copper cladding tubes. The experimental procedure will consist of critical buckling and migration area measurements at lattice pitches of 5.05-inch square and 7.07-inch square.

HAMMER code calculations give a value for $\delta\eta/\eta\delta T$ of $-0.856 \times 10^{-4}/°C$ for both test lattices. The error analysis indicates the error in flux ratios as calculated by HAMMER is greater for the 5.05-inch pitch than for the 7.07-inch pitch, while errors in the leakage terms (L^2) are greater for the wider pitch than the closer one. Thus by making use of the relative merits of the two lattices the total error in $\delta\eta/\eta\delta T$ can be reduced. The measured temperature coefficient of η is expected to have an error of less than ±13%.

Comparison of Exponential and Critical Bucklings for Simulated Burned-up Fuel

Housing tubes were not used in full exponential (SE) buckling experiments on simulated burned-up fuel while they were used in critical (PDP) experiments. HAMMER calculations accounting for the housing tubes have been run and the results used to compare the measurements in the two facilities.

Lattice	Bucklings	
		B^2, m^{-2}
19-Rod Clusters Type B Fuel* 9.33" Δ Lattice Pitch D_2O, 20°C, 99.75 mole %	SE (No housings)	5.49
	ΔB^2 Housings (HAMMER)	0.29
	SE (with housings)	5.20
	PDP (with housings)	5.29

* See DPST-66-83-8.

SECTION II

AECL IN-CORE FLUX MONITORS

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An irradiation test of in-core flux monitors is being made in one of the Savannah River Plant reactors to determine the life characteristics of a selection of flux detectors and of the mineral insulation used in their construction. Self-powered flux detectors are relatively new; therefore, confidence in their use hinges to a great extent on proven performance at large integrated exposures. The chief points of interest are 1) integrity of the conductors and sheath during life, 2) life of insulation, and 3) sensitivity. The higher flux density available at SRP (vis-à-vis Chalk River) will shorten the irradiation time for a given exposure and should also show whether or not any new high intensity effects appear.

Fabrication and installation of the detector rod in the reactor has been completed and testing is in progress. There were no special tests in February. No significant changes in the detector or cable outputs from those reported in DPST-66-83-8 have occurred. The data being collected will be reported in a separate topical report at the conclusion of the tests.

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