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MASTER

FINAL REPORT

FOIL TYPE INSULATING SLEEVE VIBRATION TEST
(Title Unclassified)

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1.0 INTRODUCTION

1.1 The present insulating sleeves, made of deposit formed pyrolytic graphite, have shown a tendency to spall under dynamic conditions. This spalling characteristic resulted in jamming and binding of the sleeves upon disassembly after completion of the partial core vibration tests. The WANL Materials Department has recently developed a foil type pyrolytic sleeve as a possible material replacement for the present deposit formed sleeves. A comparison was made of the wear and resistance to spalling of the foil type and deposit formed sleeves under vibratory conditions. A qualitative evaluation was made to provide a basis for selection of the preferred material to be used in the NRX-A2 reactor.

2.0 PURPOSE

2.1 The purpose of this test is to determine which of the various types of tie rod insulating sleeves can best withstand the NRX-A2 and NRX-A3 dynamic environment.

3.0 OBJECTIVES

- 3.1 Determine the extent of damage by observing any wear or spalling of the sleeves.
- 3.2 Compare the relative merit of the foil type and the NRX-A2 insulating sleeves with respect to galling.

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WANL-TME-903

4.0 TEST SPECIMENS

- 4.1 The components tested were deposit formed and foil type pyrolytic graphite insulating sleeves. The following types of insulating sleeves were used:
- 4.1.1 Regular deposit formed insulating sleeves conforming to NRX-A2 specifications, one set manufactured by High Temperature Materials, Inc. and the other by Super Temperature Corporation.
 - 4.1.2 Tapered (natural) insulating sleeves which were supplied by Manufacturing Services.
 - 4.1.3 Grafoil-100 insulating sleeves made of wrapped pyrolytic foil furnished by Materials Department.
- 4.2 The regular deposit formed insulating sleeves were of the present (NRX-A2) design specification and were supplied by two different manufacturers. The tapered (natural) insulating sleeves were supplied by Manufacturing Services. These sleeves were deposit formed and were the same length as the regular (NRX-A2) sleeves, however the outer diameter had a natural taper and was unmachined. The Grafoil-100 insulating sleeves were made from foil pyrolytic graphite which is wrapped and bonded together using graphite cement and cured at various temperatures.
- 4.3 Each of the four types of insulating sleeves were assembled into individual fuel cluster assemblies. The four fuel clusters containing the test specimens, along with three clusters having the standard configuration, were then assembled into the seven cluster partial core test assembly (see Figure 1). The cluster containing the foil sleeves was placed in the center of the assembly with the remaining clusters placed in the periphery.

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WANL-TME-903

5.0 TEST CONDITIONS

5.1 All testing was conducted at ambient temperatures. The clusters with the test specimens installed were vibrated laterally and axially in accordance with the load envelope shown in Table I.

6.0 TEST RESULTS

6.1 Accelerations were measured at the shaker and test fixture drive adapter for monitoring the load inputs. Qualitative inspections regarding the wear, spalling and galling were made after lateral excitation and again after axial excitation. There was no spalling or galling experienced by any of the various types of sleeves. However, the foil type and natural tapered sleeves exhibited better resistance to wear as compared to the regular deposit formed sleeves. Visual inspection of the two sets of regular (NRX-A2) sleeves revealed some powdering of the graphite at the outer (O. D.) surfaces. There was no noticeable wear or damage to the foil type or tapered sleeves.

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7 CLUSTER
VIBRATION TEST

Figure 1

SEVEN CLUSTER PARTIAL CORE TEST ASSEMBLY

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TABLE I

SEQUENCE	"G" LEVEL	FREQUENCY RANGE	SWEEP RATE	DWELL TIME	DIRECTION OF EXCITATION
1	1.0 to 5.0 in lg increments	20-2000 cps	31°/sec	-----	Lateral
2	1.0	50 cps	-----	5 min	Lateral
3	2.0	50 cps	-----	5 min	Lateral
4	3.0	50 cps	-----	5 min	Lateral
5	5.0	50 cps	-----	5 min	Lateral
6	7.0	50 cps	-----	5 min	Lateral
7	1.0 to 5.0 in lg increments	20-2000 cps	31°/sec	-----	Vertical
8	1.0	70 cps	-----	5 min	Vertical
9	2.0	70 cps	-----	5 min	Vertical
10	3.0	70 cps	-----	5 min	Vertical
11	5.0	70 cps	-----	5 min	Vertical
12	7.0	70 cps	-----	5 min	Vertical

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