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Lawrence Livermore Laboratory

DT FUSION NEUTRON IRRADIATION OF BNL-LASL SUPERCONDUCTOR WIRES, BPNL WIRE-FOIL PACKET, AND ORNL MAGNESIUM OXIDE CRYSTAL

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MASTER

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DISCLAIMER

ABSTRACT

The DT fusion neutron irradiation of eleven BNL-LASL superconductor wires, one BPNL wire-foil packet, and two ORNL magnesium oxide crystals is described. The sample position and neutron dose record are given. The maximum neutron fluence on any sample was 2.77×10^{15} neutrons/cm^2.

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Drs. Robert C. Haight and Steven M. Grimes of LLL scheduled the use of the LLL Rotating Target Neutron Source (RTNS) for the week of March 14, 1977. They allowed samples from other researchers to be put in front of their experimental apparatus during the irradiation until the additional samples interfered with their own work.

A fluence of 10^{18} neutrons/cm^2 was being accumulated on eleven superconductor wires for Dr. C. L. Snead, Jr. of Brookhaven National Laboratory (BNL) and Dr. Don M. Parkin of Los Alamos Scientific Laboratory (LASL). The wires, (19 to 28 mm long) were arranged in a single layer and wrapped in aluminum foil. This package had been irradiated during the periods July 26-29, 1976, September 27-October 1, 1976, November 17-December 2, 1977, January 3-7, 1977 and January 17-21, 1977.

Nine of the wires included in the package had received 8×10^{17} neutrons/cm^2 from RTNS irradiations prior to the present accumulation. They are three pieces of Nb_3Sn single core, three pieces V_3Ga single core, two pieces NbTi Supercon 402, and one piece of NbTi cupronickel jacketed. The remaining two wires, 19-core Nb_3Sn multifilament wires, had 1.8×10^{18} neutrons/cm^2 from previous RTNS irradiations.

A wire-foil packet, No. 4, from Drs. Russell H. Jones and David L. Styris of Battelle Pacific Northwest Laboratories (BPNL) was being repeatedly irradiated at the RTNS to build up a fluence of $5\text{-}7 \times 10^{17}$ neutrons/cm^2. The packet, containing Nb, Ni, and stainless steel samples, had been irradiated during the periods of September 27-October 1, 1976, November 17-December 2, 1976, January 3-7, 1977 and January 17-21, 1977.

Dr. Yok Chen of Oak Ridge National Laboratory (ORNL) supplied two thin MgO crystals for irradiation. They were wrapped together in aluminum foil, with a 0.03 mm thick piece of mylar between them, and designated MgO-20 and MgO-21. They had been irradiated January 3-7, 1977 and January 17-21, 1977 to start accumulating a dose of 10^{18} neutrons/cm^2.

Niobium dosimetry foils measuring 12 mm in diameter and 0.14 mm in thickness were sandwiched with the samples. The order of stacking, beginning with the material nearest the neutron source, was as follows:

Nb-808

Superconductor wires

Nb-827

Wire-foil packet, No. 4

Nb-828

MgO-20 and MgO-21

Nb-829

The neutron irraidation was carried out by the LLL E Division Accelerator Staff during the period March 14 and 15, 1977. Neutron production was monitored continuously with a proton recoil counter and recorded each hour. The dose record is attached.

Following the irradiation, the sample package was stored for a few days to allow for decay of short-lived isotopes. The dosimetry foils were delivered to Ruth Anderson in the LLL Radiochemistry Division for gamma ray counting. The samples were retained for further irradiation.

The average fluence on each dosimetry foil was calculated using the method described in UCRL-51393, Rev. 1. However, the cross section used for the activation of the 10.16 day isomer of niobium by 14.8 MeV neutrons was changed to 458 millibarns (UCID-16725). The results were as follows:

Dosimetry Foil	Fluence (neutrons/cm^2)
Nb-808	2.77×10^{15}
Nb-827	2.06×10^{15}
Nb-828	1.65×10^{15}
Nb-829	1.23×10^{15}

The estimated overall uncertainty of these results is ±7.5%. The relative uncertainty between any two values is about ±2%. The fluences given here represent average fluences over the volume of each dosimetry foil.

RTNS IRRADIATION OF MARCH 14 AND 15, 1977

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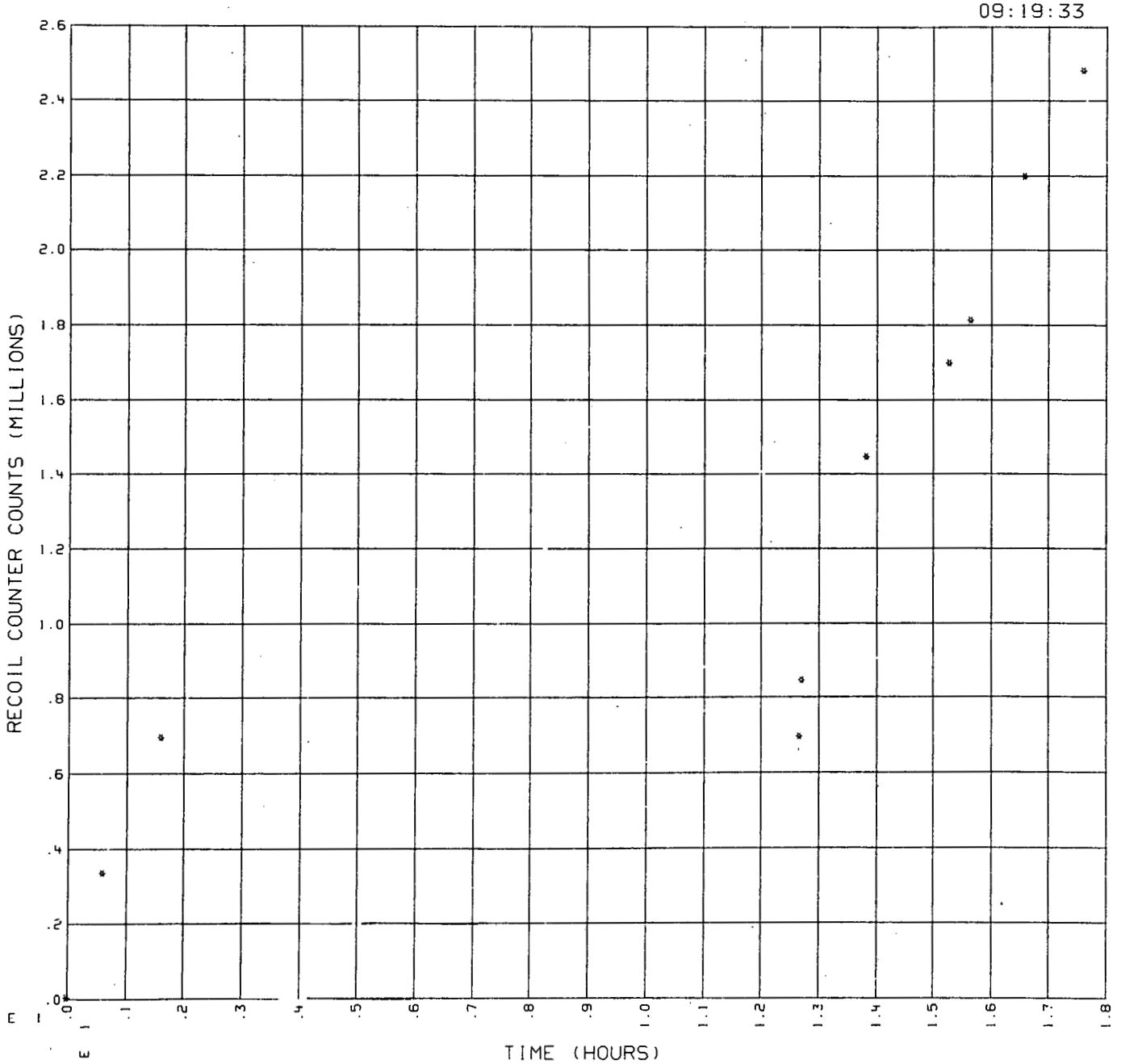

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