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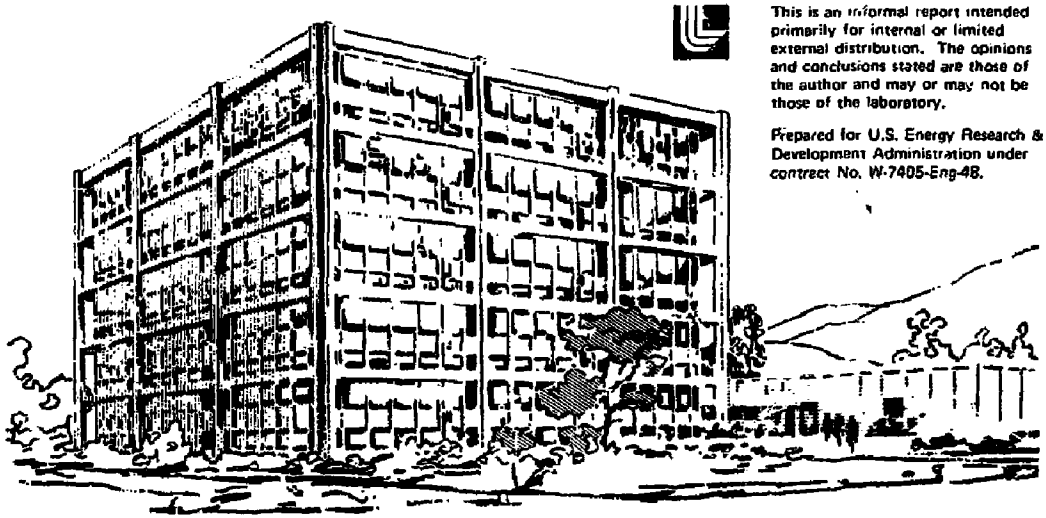
DT FUSION NEUTRON IRRADIATION OF ORNL MAGNESIUM OXIDE CRYSTALS AND BNL-LASL SUPERCONDUCTOR WIRES

Susan C. MacLean

April 26, 1978



DT Fusion Neutron Irradiation of ORNL Magnesium Oxide Crystals and BNL-LASL Superconductor Wires*

Unclassified

December 14, 1977

Susan C. MacLean

Abstract

The DT fusion neutron irradiation of two ORNL magnesium oxide crystals and eleven BNL-LASL superconductor wires is described. The sample position and neutron dose record are given. The maximum neutron fluence on any sample was 2.16×10^{16} neutrons/cm^2

* "Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore Laboratory under contract number W-7405-ENG-48."

Drs. Robert C. Haight and Steven M. Grimes of LLL scheduled the LLL Rotating Target Neutron Source (RTNS) for November 1 to 4, 1977. They generously suggested that samples from other investigators be placed in front of their experimental apparatus during the irradiation.

Two thin magnesium oxide crystals were being irradiated repeatedly in order to accumulate a fluence of 10^{18} neutrons/cm^2 for Dr. Yok Chen of Oak Ridge National Laboratory (ORNL). The samples (MgO-20 and MgO-21) had a piece of 0.03 mm thick mylar between them and were wrapped in aluminum foil. They had been irradiated January 3-7, 1977, January 17-21, 1977, March 14-15, 1977 and August 15-19, 1977.

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 wrapped in aluminum foil in a single layer. This package had been irradiated July 26-29, 1976, September 27-October 1, 1976, November 17-December 2, 1976, January 3-7, 1977, January 17-21, 1977, March 14-15, 1977, August 15-19, 1977, August 30, 1977, and October 26, 1977.

Nine of the wires (3 Nb_3Sn single core, $3V_3Ga$ single core, 2 NbTi Supercon 402, and 1 NbTi cupronickel jacketed) had received approximately 8 x 10^{17} neutrons/cm^2 from RTNS irradiations prior to the present accumulation. The other two wires (19-core Nb_3Sn multifilament wires) had received approximately 1.8 x 10^{18} neutrons/cm^2 from previous RTNS irradiations.

The samples were stacked with niobium dosimetry foils (12 mm in diameter, 0.03 mm thick) as follows, beginning with the material nearest the neutron source:

Nb-1004
Mg-21 } Al foil
Mg-20 }
Nb-1003
Superconductor Wires
Nb-1002

The neutron irradiation was carried out by the LLL E Division Accelerator Staff during November 1 to 4, 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 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 463 millibarns (UCRL-80097). The results were as follows:

Dosimetry Foil	Fluence (neutrons/cm^2)
Nb-1004	2.16×10^{16}
Nb-1003	1.63×10^{16}
Nb-1002	1.43×10^{16}

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.

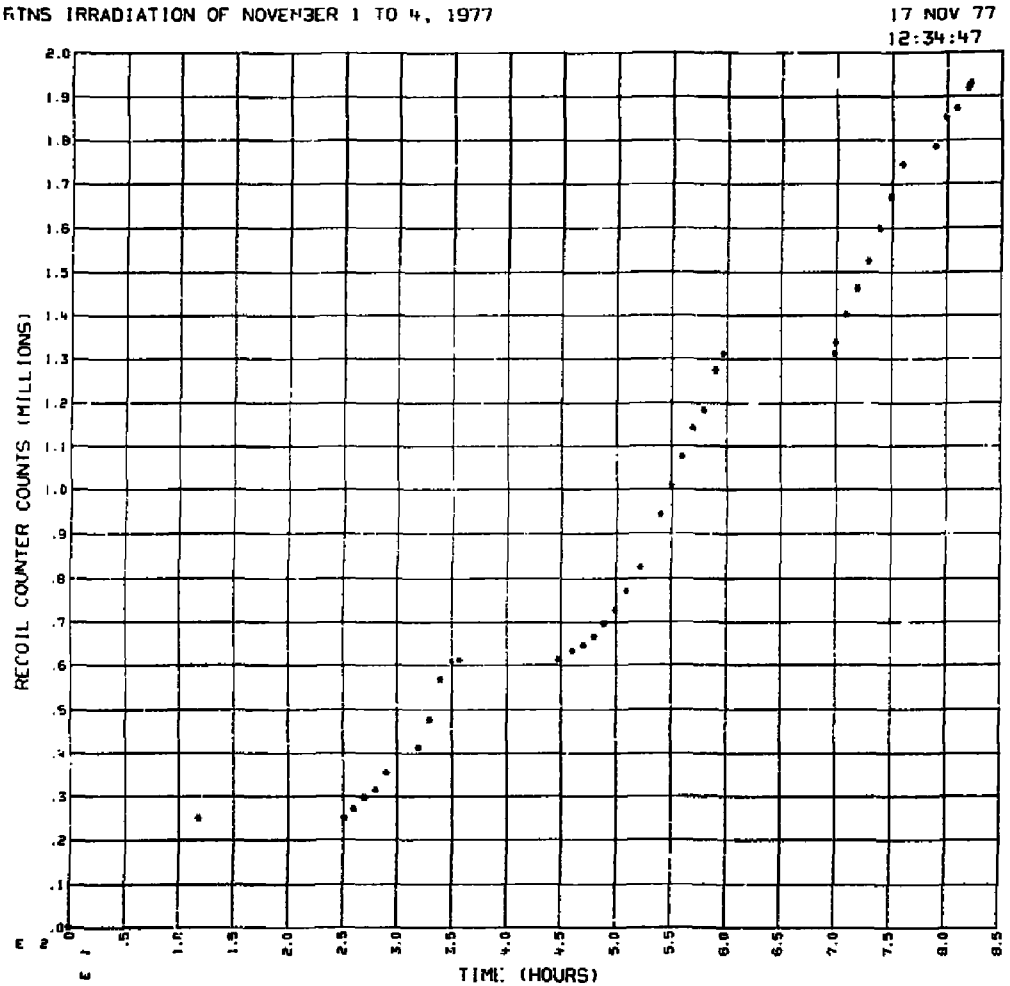

RTNS IRRADIATION OF NOVEMBER 1 TO 4, 1977
17 NOV 77
12:34:47
RECOIL COUNTER COUNTS (MILLIONS)
TIME (HOURS)

Fig. 1

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