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

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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 dose record are given. The maximum neutron fluence on any sample was 2.03×10^{16} neutrons/cm².

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DT Fusion Neutron Irradiation of BNL-LASL Superconductor Wires, BPNL
Wire-Foil Packet, and ORNL Magnesium Oxide Crystals

March 3, 1977

Susan C. MacLean

Drs. Robert C. Haight and Steven M. Grimes of LLL scheduled the LLL Rotating Target Neutron Source (RTNS) for the week of January 3 to 7, 1977. They generously agreed to have samples from other experimenters placed between their experimental apparatus and the neutron source.

Eleven superconductor wires from Dr. C. L. Snead, Jr. of Brookhaven National Laboratory (BNL) and Dr. Don M. Parkin of Los Alamos Scientific Laboratory (LASL) were being repeatedly irradiated in order to accumulate a fluence of 10^{18} neutrons/cm². The wires (19 to 28 mm long) were put in a single layer and wrapped in aluminum foil. They had been irradiated during the periods July 26-29, 1976, September 27 - October 1, 1976, and November 17 - December 2, 1976. Nine of the wires (3 Nb₃Sn single core, 3 V₃Ga single core, 2 NbTi Supercon 402, and 1 NbTi cupronickel jacketed) had received 8×10^{17} neutrons/cm² from RTNS irradiations prior to the present accumulation. The remaining two wires (19-core Nb₃Sn multifilament wires) had received 1.8×10^{18} neutrons/cm² from previous RTNS irradiations.

Drs. Russell H. Jones and David L. Styris of BPNL supplied a wire-foil packet, No. 4, to be irradiated to $5-7 \times 10^{17}$ neutrons/cm². The packet had previously been irradiated, September 27 - October 1, 1976 and November 17 - December 2, 1976. The sample packet was placed so that the wires were toward the neutron source and the beam center was approximately 26 mm from the reference corner of the supporting foil, as requested.

Two MgO crystals from Dr. Yok Chen of Oak Ridge National Laboratory were wrapped together, with a piece of 0.03 mm thick mylar between them, in aluminum foil. The samples were designated MgO-20 and MgO-21. A fluence of 10^{18} neutrons/cm² was requested for them.

The samples were stacked with niobium dosimetry foils, 0.14 mm thick and 12 mm in diameter. The order of stacking was as follows:

Nb-789
Superconductor wires
Nb-790
Wire-foil packet, No. 4
Nb-791
MgO-20 and MgO-21
Nb-792

The neutron irradiation was carried out by the LLL E Division Accelerator Staff during the period January 3 to 7, 1977. The dose record is attached.

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

The average fluence on each 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. The results were as follows:

<u>Dosimetry Foil</u>	<u>Fluence (neutrons/cm²)</u>
Nb-789	2.03×10^{16}
Nb-790	1.68×10^{16}
Nb-791	1.35×10^{16}
Nb-792	9.82×10^{15}

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

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