Lawrence Livermore Laboratory

DT FUSION NEUTRON IRRADIATION OF TWO LLL
SUPERCONDUCTOR WIRES AT 4.2°K

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ABSTRACT

The DT fusion neutron irradiation of two LLL superconductor wires at 4.2°K is described. The sample position, beam — on time, and neutron dose record are given. The results from four "profile" dosimetry foils measuring the lateral variation in neutron flux are included.

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DT FUSION NEUTRON IRRADIATION OF TWO LLL
SUPERCONDUCTOR WIRES AT 4.2°K.

During the two weeks of December 6 to 17, 1976, the LLL Rotating Target Neutron Source (RTNS) was reserved for Dr. Ronald M. Scanlan of LLL. His samples were two superconductor wires held at 4.2°K.

The samples and two niobium dosimetry wires and a niobium dosimetry foil were held on a copper sample holder. The dosimetry wires (approximately 12 mm long and 0.25 mm in diameter) were parallel to each other and 11 mm apart. The sample wires were between the dosimetry wires, parallel to them and each was 1 mm from a dosimetry wire. A 0.14 mm thick niobium foil, measuring approximately 6 mm square, was centered between the sample wires. The dosimetry foil was designated Nb-RS-6. The dosimetry wire nearest sample 1 was called Nb-RS-7, and the dosimetry wire closest to sample 2 was Nb-RS-8.

A niobium foil, 25.4 mm square, was scribed into 16 equal squares, labeled and centered on the front of the Helitran containing the superconductor samples and dosimetry materials. The "profile" foil was positioned so that the horizontal lines on it were parallel with the sample orientation. The squares of the "profile" foil were labeled with a number and letter. The number indicated the horizontal row and the letter designated the vertical column.

Four "profile" foils were used during the irradiation. Each time the Helitran was moved to make sample measurements, a new foil was put in place before the irradiation was resumed. This occurred on December 6, 9, 13, and 15, 1976.

The irradiation was carried out by the E Division Accelerator Staff during the period December 6 to 17, 1976. Neutron production was monitored continuously with a proton recoil counter and recorded each hour. Total beam -- on time was 146.43 hours. The dose record is attached.

Following the irradiation, the profile foils were cut along the scribed lines and the pieces weighed. The niobium dosimetry wires and foils were delivered to Ruth Anderson in the LLL Radiochemistry Division. She carried out the gamma ray counting.

The average fluence of each dosimeter 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 neutrons was changed to 458 millibarns. The results were as follows:

<u>Dosimeter</u>	<u>Fluence (neutrons/cm²)</u>
Nb-RS-6	1.07×10^{17}
Nb-RS-7	5.42×10^{16}
Nb-RS-8	7.96×10^{16}

December 6 to 8, 1976 Profile Foil:

Nb-773A 1.14×10^{16}	Nb-773B 1.54×10^{16}	Nb-773C 1.26×10^{16}	Nb-773D 8.00×10^{15}
Nb-774A 1.87×10^{16}	Nb-774B 2.89×10^{16}	Nb-774C 2.26×10^{16}	Nb-774D 1.15×10^{16}
Nb-775A 1.81×10^{16}	Nb-775B 3.01×10^{16}	Nb-775C 2.56×10^{16}	Nb-775D 1.25×10^{16}
Nb-776A 1.09×10^{16}	Nb-776B 1.64×10^{16}	Nb-776C 1.53×10^{16}	Nb-776D 8.98×10^{15}

December 9 to 10, 1976 Profile Foil:

Nb-777A 1.01×10^{16}	Nb-777B 1.48×10^{16}	Nb-777C 1.41×10^{16}	Nb-777D 9.62×10^{15}
Nb-778A 1.55×10^{16}	Nb-778B 2.55×10^{16}	Nb-778C 2.44×10^{16}	Nb-778D 1.42×10^{16}
Nb-779A 1.64×10^{16}	Nb-779B 2.69×10^{16}	Nb-779C 2.55×10^{16}	Nb-779D 1.46×10^{16}
Nb-780A 1.13×10^{16}	Nb-780B 1.64×10^{16}	Nb-780C 1.52×10^{16}	Nb-780D 9.98×10^{15}

December 13 to 14, 1976 Profile Foil:

Nb-781A 1.25×10^{16}	Nb-781B 1.78×10^{16}	Nb-781C 1.77×10^{16}	Nb-781D 1.26×10^{16}
Nb-782A 2.05×10^{16}	Nb-782B 3.46×10^{16}	Nb-782C 3.46×10^{16}	Nb-782D 2.01×10^{16}
Nb-783A 2.33×10^{16}	Nb-783B 4.08×10^{16}	Nb-783C 4.02×10^{16}	Nb-783D 2.20×10^{16}
Nb-784A 1.59×10^{16}	Nb-784B 2.51×10^{16}	Nb-784C 2.41×10^{16}	Nb-784C 1.50×10^{16}

December 15 to 17, 1976 Profile Foil:

Nb-785A 2.27×10^{16}	Nb-785B 3.35×10^{16}	Nb-785C 3.08×10^{16}	Nb-785D 2.07×10^{16}
Nb-786A 3.95×10^{16}	Nb-786B 6.63×10^{16}	Nb-786C 5.98×10^{16}	Nb-786D 3.13×10^{16}
Nb-787A 4.49×10^{16}	Nb-787B 7.42×10^{16}	Nb-787C 6.51×10^{16}	Nb-787D 3.23×10^{16}
Nb-788A 1.51×10^{16}	Nb-788B 4.31×10^{16}	Nb-788C 3.80×10^{16}	Nb-788D 2.18×10^{16}

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 dosimeter.

RTNS IRRADIATION OF DECEMBER 6 TO 17, 1976

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