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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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Dr. Ronald M. Scanlan of LLL reserved two weeks at the LLL Rotating Target Neutron Source (RTNS) beginning August 1, 1977. The samples to be irradiated were two superconductor wires held at 4.2°K.

The samples and three niobium dosimetry wires were held parallel to each other on a copper sample holder. The niobium wires were roughly 12 mm in length and approximately 0.25 mm in diameter. Dosimetry wire Nb-W2 was centered between the sample wires, approximately 1.25 mm from each. Nb-W1 was on the opposite side of the BNL mono wire specimen and approximately 1.25 mm from it. Dosimeter Nb-W3 was similarly positioned with respect to the superconductor AIRCO 1045 sample.

A niobium foil, 25.4 mm square and about 0.13 mm thick, was scribed into 16 equal squares, labeled, and centered on the front of the Helitran containing the superconducting samples and dosimetry wires. 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 August 1, 3, 8 and 10, 1977.

The irradiation was carried out by the E Division Accelerator Staff during the period August 1 to 12, 1977. Neutron production was monitored continuously with a proton recoil counter and recorded each hour. The total beam-on time was 141.75 hours. The dose record is attached.

Following the irradiation, the profile foils were cut along the scribed lines and the pieces weighed. All the niobium dosimetry foils and wires were given to Ruth Anderson in the LLL Nuclear Chemistry Division for 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 MeV neutrons was changed to 463 millibarns (UCRL-80097). The results were as follows:

<u>Dosimeter</u>	<u>Fluence (neutrons/cm²)</u>
Nb-W1	8.48×10^{16}
Nb-W2	7.42×10^{16}
Nb-W3	6.35×10^{16}

August 1 to 2, 1977 Profile Foil:

847A 8.95×10^{15}	847B 1.33×10^{16}	847C 1.25×10^{16}	847D 8.09×10^{15}
848A 1.57×10^{16}	848B 2.90×10^{16}	848C 2.61×10^{16}	848D 1.23×10^{16}
849A 1.72×10^{16}	849B 3.31×10^{16}	849C 2.82×10^{16}	849D 1.30×10^{16}
850A 1.12×10^{16}	850B 1.73×10^{16}	850C 1.54×10^{16}	850D 9.04×10^{15}

August 3 to 5, 1977 Profile Foil

851A 6.82×10^{15}	851B 1.05×10^{16}	851C 1.31×10^{16}	851D 1.11×10^{16}
852A 1.07×10^{16}	852B 2.22×10^{16}	852C 3.32×10^{16}	852D 2.24×10^{16}
853A 1.31×10^{16}	853B 3.24×10^{16}	853C 5.18×10^{16}	853D 3.31×10^{16}
854A 1.12×10^{16}	854B 2.28×10^{16}	854C 3.08×10^{16}	854D 2.07×10^{16}

August 8 to 9, 1977 Profile Foil:

855A 1.12×10^{16}	855B 1.92×10^{16}	855C 1.99×10^{16}	855D 1.27×10^{16}
856A 1.88×10^{16}	856B 4.45×10^{16}	856C 4.79×10^{16}	856D 2.19×10^{16}
857A 1.89×10^{16}	857B 4.59×10^{16}	857C 4.99×10^{16}	857D 2.28×10^{16}
858A 1.17×10^{16}	858B 2.07×10^{16}	858C 2.22×10^{16}	858D 1.37×10^{16}

August 10 to 12, 1977 Profile Foil:

859A 1.54×10^{16}	859B 2.33×10^{16}	859C 2.24×10^{16}	859D 1.46×10^{16}
860A 2.68×10^{16}	860B 5.46×10^{16}	860C 5.07×10^{16}	860D 2.40×10^{16}
861A 2.95×10^{16}	861B 6.71×10^{16}	861C 6.40×10^{16}	861D 2.76×10^{16}
862A 1.93×10^{16}	862B 3.47×10^{16}	862C 3.33×10^{16}	862D 1.86×10^{16}

The estimated 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 AUGUST 1 TO 12, 1977

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Fig. 1