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DT FUSION NEUTRON IRRADIATION OF LLL 316

STAINLESS STEEL

Unclassified

September 9, 1976

Susan C. MacLean

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Drs. Robert C. Haight and Steven M. Grimes of LLL scheduled the LLL Rotating Target Neutron Source (RTNS) for the end of June, 1976. They generously agreed to have Dr. Richard L. Vandervoort of LLL include samples between their experimental apparatus and the neutron source during the irradiation.

Dr. Vandervoort had six 316 stainless steel samples. Four were tensile specimens with gauge sections measuring approximately 1.6 x 6 x 0.5 mm. These were designated P-1, P-2, C-1, and C-2 and were stacked with 0.13 mm thick niobium dosimetry foils of the same size and shape. Sample P-3 measured approximately 4 x 8 x 0.5 mm and was put in a hole in 0.25 mm thick mylar in order to be held securely in place, centered behind the gauge sections of the tensile specimens. Niobium dosimetry foils were sandwiched around the sample and held in place by mylar spacers. The P-3 sample and its dosimetry foils and mylar spacers were all taped together.

Cardboard spacers were used to hold sample C-3, measuring approximately 10 x 10 x 0.5 mm, centered. Niobium dosimetry foils of the same size were held on each side of the sample by cardboard spacers and the packet was taped together.

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A fiberglass laminate sample holder, 5.6 mm thick, was used, with the stacking of samples, starting with the material nearest the neutron source, as follows:

Front mylar

Nb-604

316 S.S., P-1

Nb-605

316 S.S., C-1

Nb-606

Nb-607

316 S.S., P-3

Nb-608

Nb-609

316 S.S., C-3

Nb-610

Nb-611

316 S.S., P-2

Nb-612

316 S.S., C-2

Nb-613

Back mylar

The sample holder was aligned with optically projected crosshairs and then taped to a piece of stainless steel flush with the water-catch cage of the target. A copper foil with a 6 mm hole was centered on the

back of the sample holder. An autoradiograph of the copper was made after a few minutes of irradiation and showed the samples to be well centered with the neutron beam.

The neutron irradiation was carried out by the LLL E Division Accelerator Staff during the period June 22 to 29, 1976. Neutron production was monitored continuously with a proton recoil counter and recorded each hour. The dose record is attached.

Following the irradiation, the sample holder was stored for several days to allow short-lived isotopes to decay. An autoradiograph of the front of the sample holder indicated that the centering had been excellent.

The 316 stainless steel samples were rescheduled for further RTNS irradiation before they were "cool" enough to reload with new niobium dosimetry foils. Therefore, a niobium tensile specimen shaped foil was centered over the samples on the front and on the back of the sample holder for the second irradiation. Following the second irradiation, July 8 to 21, 1976, the tensile specimen shaped dosimetry foils were cut and weighed so that only the portions corresponding to the gauge sections were delivered with the other dosimetry foils to Austin L. Prindle in the LLL Radiochemistry Division for gamma ray counting.

In order to calculate the fluences for the interior intermediate foils for the June 22 to 29, 1976 irradiation, the measured ^{92m}Nb dpm/gm for each foil needed to be corrected. Using the dpm/gm for the front and back exterior foils and interpolating for each intermediate foil gave the dpm/gm for each foil for the second irradiation. This value was

subtracted from the measured dpm/gm and corrected for the time difference between the end of the first run and the end of the second run to give the correct dpm/gm at the end of the first irradiation period. Then the average fluence for each foil could be calculated as described in UCRL-51393, Rev. 1, with the exception that 458 millibarns was used as the cross section for the activation of ^{92m}Nb , the 10.16 day isomer, by 14.8 MeV neutrons.

The results were as follows:

<u>Dosimetry Foil</u>	<u>Fluence (neutrons/cm²)</u>
Nb-604	4.11×10^{16}
Nb-605	3.45×10^{16}
Nb-606	2.97×10^{16}
Nb-607	2.75×10^{16}
Nb-608	2.31×10^{16}
Nb-609	2.04×10^{16}
Nb-610	1.80×10^{16}
Nb-611	1.80×10^{16}
Nb-612	1.56×10^{16}
Nb-613	1.40×10^{16}

The estimated overall uncertainty of these results is $\pm 10\%$. 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.

RTNS IRRADIATION OF JUNE 22 TO 29, 1976

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