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DT Fusion Neutron Irradiation of WRCD Heat Resisting Alloys,
ORNL Magnesium Oxide Crystal, BPNL Molybdenum, LLL Graphite, and LLL Optical Glass
Unclassified
Susan C. MacLean

November 26, 1974

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DT Fusion Neutron Irradiation of WRCD
Heat Resisting Alloys, ORNL Magnesium Oxide Crystal,
BPNL Molybdenum, LLL Graphite, and LLL Optical Glass*

Susan C. MacLean

November 15, 1974

In order to use the LLL Rotating Target Neutron Source (RTNS) efficiently, samples from several experimenters were included during one irradiation period, October 7-9, 1974.

On July 22, 1974, a sample package was received from Drs. Leonard R. Fleischer and John A. Spitznagel of Westinghouse Research and Development Center (WRDC). Irradiation of the packet by the LLL RTNS was requested. The sample package consisted of a plexiglass container with 21 microscope sample foils arranged in three layers and separated by molybdenum foils. The packet was radioactive because it contained three pieces of EBR-II irradiated 316 stainless steel. The other sample foils were 304 stainless steel and Inconel X-750. Two niobium dosimetry foils provided by R. Van Konynenburg of LLL were attached to the packet, Nb-62 on the front and Nb-63 on the back.

Dr. Yok Chen of Oak Ridge National Laboratory (ORNL) requested a larger fluence on a magnesium oxide crystal. This sample, MgO-8, had previously been irradiated January 14-16, 1974, May 29-31, 1974, July 16-18, 1974, and September 11, 1974.

Molybdenum samples belonging to Dr. John L. Brimhall of Battelle Pacific Northwest Laboratories (BPNL) had been irradiated September 11, 1974, but required further irradiation to obtain the fluence he requested. The molybdenum samples were placed in a stainless steel washer for the irradiation.

Dr. Richard J. Borg of LLL provided four high purity graphite samples for irradiation. Samples G-1 and G-2 were Speers 700 Grade graphite measuring approximately 8 mm by 10.5 mm by 0.21 mm thick. Samples G-3 and G-4 were H.T.M. Pyro Grade graphite approximately 9 mm by 11 mm by 0.15 mm in size.

* This work was performed under the auspices of the U.S. Atomic Energy Commission.

Dr. Michael Schwab and Michael Moran of LLL requested irradiation of six pieces of BK7 optical glass. The samples were approximately 2 mm by 2 mm by 5 mm. It was desired that the fluence on each block of glass be less than the fluence on the preceding block by a factor of ten.

With the exception of the glass specimens, the samples were loaded into an epoxy-fiberglass laminate sample holder with niobium dosimetry foils. The optical glass blocks were Scotch taped with niobium dosimetry foils to the outside of the sample holders (the back of sample holder A; the front of holders B, C, D, E, and F). The dosimetry foil on sample holder E was a double thickness and on holder F was a triple thickness. The sample holders were arranged along an aluminum rod. The order of stacking, beginning with the material nearest the neutron sources, was as follows:

<u>Order</u>	<u>Sample Holder</u>	<u>Sample</u>	<u>Distance from Source</u>
1	A	Mylar	3 mm
2		Nb-62	
3		Fleischer's packet	
4		Nb-63	
5		Mylar	
6		Graphite, G-1	
7		Graphite, G-3	
8		Graphite, G-2	
9		Graphite, G-4	
10		Nb-123	
11		Mylar	
12		MgO-8, wrapped in aluminum foil	
13		Nb-124	
14		Mylar	
15		Nb-160	
16		Brimhall's packet	
17		Nb-161	
18		Glass, BK7-5	
19	B	Glass, BK7-6	40 mm
20		Nb-162	

<u>Order</u>	<u>Sample Holder</u>	<u>Sample</u>	<u>Distance from Source</u>
21	C	{Glass, BK7-7	126 mm
22		{Nb-163	
23	D	{Glass, BK7-8	385 mm
24		{Nb-164	
25	E	{Glass, BK7-9	1.111 meters
26		{Nb-165a and b	
27	F	{Glass, BK7-10	1.121 meters
28		{Nb-166a, b and c	

The irradiation was performed by the E Division Accelerator Staff of LLL during the period October 7 to 9, 1974. Neutron production was monitored continuously with a proton recoil counter and recorded each hour. Sample holder F was removed after 5.26 hours of irradiation. Total beam-on time for the rest was 45.88 hours. The dose record is attached.

The sample holder assembly was removed and stored for a few days to allow for decay of short-lived isotopes. Fracturing of sample holder A indicated that the samples had been centered to within 2 mm of the center of the neutron source.

The samples were removed from the holders. The stainless steel and Inconel foils were shipped to WRDC. The graphite samples were returned to R. Borg, and the glass samples to M. Moran. The packet of molybdenum samples and MgO-8 were retained for further irradiation.

The niobium dosimetry foils were delivered to the LLL Radiochemistry Division where Ruth Anderson performed the gamma ray counting. The average fluence of each foil was calculated as described in UCRL-51393, Rev. 1. The results were as follows:

<u>Dosimetry Foil Number</u>	<u>Fluence (n/cm²)</u>
Nb-62	1.32×10^{17}
Nb-63	8.42×10^{16}
Nb-123	6.48×10^{16}
Nb-124	4.98×10^{16}
Nb-160	3.30×10^{16}
Nb-161	2.97×10^{16}
Nb-162	2.70×10^{15}

<u>Dosimetry Foil Number</u>	<u>Fluence (n/cm²)</u>
Nb-163	2.77×10^{14}
Nb-164	2.98×10^{13}
Nb-165a and b	3.57×10^{12}
Nb-166a, b and c	4.39×10^{11}

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

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