C-AD

Radiation

Safety Minutes of Radiation Safety Sub-Committee Meeting

Committee on Dec. 9, 2011

Issued: December 30, 2011

Subject: Re Coated Nb Target Holders

Present: R. Karol, L. Mausner, and D. Beavis

Improvements[1] to the Nb target holder are needed in order to improve the production of Ge-68. It has been found the high temperature (approx. 400° C) Ga can make pin holes in the Nb target holder. As the temperature rises especially above 400° C the resistance of the Nb to attack by the Ga target material is reduced. This issue has been reduced in the past by making the beam spot larger and thus reducing the energy density (also temperature) but with the result of lower Ge-68 production.

Re is more resistant to attack by Ga than Nb and is resistant to temperatures of 600° C. Re is expensive and therefore the option to coat the Nb container has been chosen rather than a solid Re holder. Many of the issues were reviewed before the meeting through a series of e-mail exchanges. Contributing to these discussions were E.T. Lessard, P. Cirnigliaro, M. Clancy, and members of this subcommittee.

A calculation[1] of the radioisotopes produced from the Re was conducted by A. Hanson. The following table of isotopes produced from the Re was provided:

Sorted for the Highest Activity After 30-day Decay

	EOB			Activity in Curies After a Decay of:				
	14-day	1s	1hr	8hr	16hr	1d	7d	30d
Total	7.56E+00	7.56E+00	7.28E+00	6.31E+00	5.45E+00	4.78E+00	1.24E+00	5.71E-02
Re186	3.17E-02	3.17E-02	3.17E-02	3.15E-02	3.13E-02	3.11E-02	2.79E-02	1.85E-02
Re188	4.26E+00	4.26E+00	4.22E+00	4.00E+00	3.77E+00	3.54E+00	1.18E+00	1.73E-02
Re184	1.30E-02	1.30E-02	1.30E-02	1.30E-02	1.29E-02	1.29E-02	1.22E-02	9.68E-03
Re182	5.65E-03	5.65E-03	5.65E-03	5.64E-03	5.62E-03	5.61E-03	5.37E-03	4.53E-03
Re181	3.12E-03	3.12E-03	3.12E-03	3.17E-03	3.21E-03	3.24E-03	3.23E-03	2.83E-03
Re183	2.91E-03	2.91E-03	2.91E-03	2.90E-03	2.89E-03	2.88E-03	2.73E-03	2.20E-03
Os185	1.83E-03	1.83E-03	1.83E-03	1.81E-03	1.79E-03	1.77E-03	1.46E-03	7.01E-04
W187	1.83E-03	1.83E-03	1.83E-03	1.81E-03	1.79E-03	1.77E-03	1.46E-03	7.01E-04
W181	6.17E-04	6.17E-04	6.17E-04	6.17E-04	6.16E-04	6.15E-04	6.00E-04	5.45E-04
W185	9.77E-05	9.77E-05	9.79E-05	9.80E-05	9.80E-05	9.80E-05	9.74E-05	9.51E-05
Ta178	1.45E-03	1.45E-03	1.45E-03	1.39E-03	1.33E-03	1.27E-03	5.61E-04	2.46E-05
W178	3.45E-02	3.45E-02	3.41E-02	3.16E-02	2.90E-02	2.66E-02	5.59E-03	1.42E-05

Os183	5.76E-06	5.76E-06	5.76E-06	5.75E-06	5.74E-06	5.73E-06	5.52E-06	4.81E-06
Ta177	3.72E-06	3.72E-06	3.72E-06	3.72E-06	3.72E-06	3.72E-06	3.71E-06	3.70E-06
Ta183	7.65E-05	7.61E-05	7.22E-05	6.94E-05	6.64E-05	6.34E-05	2.81E-05	1.23E-06

Data are truncated at an activity of 1 microCurie at 30 day decay.

P. Cirnigliaro addressed[2]the issue of Os oxides. If the entire amount of the produced Os was released as OsO4 into one cubic meter of air the concentration would be a factor of 30 below the STEL. OsO2 is not expected to be generated at the temperatures present in the BLIP target.

L. Mausner contacted waste management to determine if the potential changes in the radio-nuclides in the waste stream would have an impact. The reply[3] from M. Clancy was that the disposal path for the target holders would be unchanged but they would check the gamma spectrum for any changes.

The potential release due to a leak was examined. The Os-185 emits a prominent gamma at 646 keV and is easily detected[4] in the BLIP cooling water. [Note –Leaks in this target are primarily detected with gamma rays from Zn-65 and Ge-69, the major products from Ga irradiation. Also, since there will be 2000 times more Re-188 produced than Os-185 in the Re layer, it is likely that detection of Re-188 will give a faster, more sensitive indication that not only has the Nb cladding failed but that the interior coating has become mobile. Gamma assay of HP smear will be conducted to assure that there has been no leakage.
There is a difference in thermal expansion for the two metals. The Nb has a coefficient of thermal expansion (CTE) of 7.3 micro-m/(m-K) while Re has a CTE of 6.2 micro-m/(m-K). A sample of coated Re was raised to a temperature of 400o C in a furnace and not found to have an mechanical separation. Cyclic heating was not performed.

The target holder was approved for use.

References

1. L. Mausner e-mail of Nov. 29, 2011
2. P. Cirnigliaro e-mail of Nov. 30, 2011
3. M. Clancy e-mail of Nov. 30, 2011
4. L. Mausner e-mail of Nov. 30, 2011

CC:

Present
RSC
RSC BLIP folder
RSC minutes online
P. Cirnigliaro
M. Clancy