



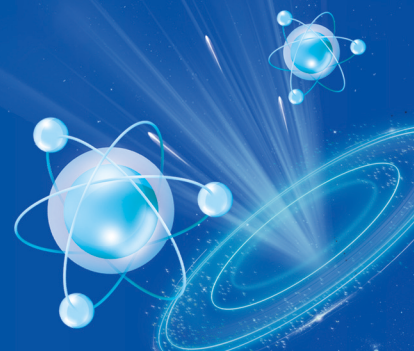
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TERBIUM RADIONUCLIDES PRODUCTION BY DEUTERON BEAMS IRRADIATION FOR MEDICAL APPLICATIONS

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The uniqueness in the terbium family consists in the fact that it has four radioisotopes of interest from a medical point of view: Tb-155 (half-life = 5.32 d) and Tb-152 (half-life = 17.5 h) can be used for SPECT and PET respectively; the properties of Tb-161 (half-life = 6.89 d) make it interesting from a therapeutic point of view because it allows a combined therapy with beta- and Auger electrons which has proved to be very effective in preclinical studies; finally, Tb-149 (half-life = 4.1 h) can be proposed for metabolic radiotherapy with alpha particles, therefore of interest for small metastases, with the associated possibility of diagnostics with PET due to the associated β^+ emission [1].

New measurements and data set for the ${}^{\text{nat}}\text{Dy}(d,x)^{149,152,155,161}\text{Tb}$ nuclear reaction are needed due to the lack of experimental data in literature. The stacked-foil activation technique irradiating at different energies thin natural Dy targets by deuteron beams was used to experimentally determine the excitation functions of the terbium isotopes and contaminants in the energy range between 15 MeV and 32 MeV. The irradiations were carried out at the ARRONAX Cyclotron Center, Nantes, France (E_d up to 35 MeV and 750 μA intensity) with a constant current of about 150 nA for a duration of 1 h. The irradiated targets were analyzed at LASA Laboratory in Milano.

We present preliminary results of the activation cross-sections of deuteron induced nuclear reactions for ${}^{\text{nat}}\text{Dy}(d,x)^{155,161}\text{Tb}$ production and of the other co-produced contaminants, and we compare them with the other data sets presented in literature and with the results of simulation with EMPIRE 3.2.2 and TALYS codes.

- [1] Müller, C., Domnanich, K. A., Umbricht, C. A. & van der Meulen, N. P. (2018). Scandium and Terbium Radionuclides for Radiotheranostics: Current State of Development Towards Clinic. Appl. British J. of Rad. 91 (1091): 20180074. <https://doi.org/10.1259/bjr.20180074>.
[2] Tárkányi, F. & al. (2014). Activation Cross-Sections of Long Lived Products of Deuteron

Induced Nuclear Reactions on Dysprosium up to 50MeV. Applied radiation and isotopes, 83: 18–24. <https://doi.org/10.1016/j.apradiso.2013.10.011>.

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