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Development of Enriched Gadolinium Target for Cross Section Measurement and Future Production of Terbium

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Short-lived radioisotopes of the terbium family show great prospects in theranostics nuclear medicine, especially 155Tb which can be used for single-photon emission tomography (SPECT) and for Auger therapy. Nevertheless, 155Tb is mainly produced by spallation nuclear reactions; insufficient production and high cost have limited its application. An alternative way to increase their availability is to use enriched gadolinium targets with low energy accelerators through reactions with light particles, the concerned reaction in this work is 155Gd (d, n)155Tb.

In this work, the electrochemical co-deposition method has been developed to provide a thin Ni/Gd2O3 composite target in order to measure the reaction cross sections. Ten targets with a thickness of 10-20 μm containing 2-3 mg of gadolinium have been irradiated at GIP ARRONAX cyclotron with deuteron beams. Cross sections of 155Tb and other impurities (153Tb, 154Tb and 156Tb) have been measured at 5-30 MeV. These measurement data, as the only available experimental data, have been compared with simulation data of Tendl-2019, and have been used to estimate the production yield.

Thicker targets were then prepared by pelletizing. Uniform and compact Gd2O3 pellets with a thickness of 600 μm have been manufactured. These pellets will be irradiated in the next step of the work for mass routine production.

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