Abstract for WTTC Nuclear excitation functions for medical isotope production: targeted radionuclide therapy via ^{nat}Ir(d,2n)^{193m}Pt

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A series of stacked target thin-foil activation experiment was conducted at the Lawrence Berkeley National Laboratory's 88-Inch Cyclotron, as part of a larger campaign to address deficiencies in cross-section nuclear data needs. One recent effort has focused on the production of platinum radionuclides, which are desired for therapautic radiopharmaceutical application. In this experiment, natural iridium foils were irradiated with a 33 MeV deuteron beam, along with copper, nickel and iron monitor foils The well-known cross sections of these monitor foils were used to determine the deuteron current and beam energy, to measure the cross sections for ^{nat}Ir(d,x) reactions between ca. 4-33 MeV, along with reactions in the monitor foils. In this measurement, the ^{nat}Ir(d,2n)^{193m}Pt reaction was of special interest due to the potential of ^{193m}Pt ($t_{1/2} = 4.33$ days) as an auger-emitter in targeted radionuclide therapy.

Targeted radionuclide therapy is an emerging alternative to traditioanal external beam radiotherapy, where healthy tissue can be spared from exposure to radiation through the use of short-ranged dose delivery. ^{193m}Pt emits approximately 25 high-LET auger, Coster-Kronig and super Coster-Kronig electrons with energies ranging up to 10 keV and ca. 3 conversion electrons with energies 126.738 keV, along with a contribution from X-rays. This cascade of electrons results in a high local deposition of energy with a range that is smaller than the cellular nucleus, delivering a more localized dose than alpha or beta-emitters. When bound to DNA, this electron cascade induced multiple double stranded breaks, effectively inducing cell death for the treatment of tumors and metastases. To produce ^{193m}Pt in the quantities needed for clinical applications, it is necessary to find the deuteron beam energy that produced the purest quantity, minimizing the production of other contaminant Pt-isotopes. The highest measured cross section was 148.98±5.54 mb at 13.51±2.50 MeV.