Molecular Plating: technique for study cross section measurements of Tb radionuclide production from $^{nat}Gd(p,x)^{155}Tb$

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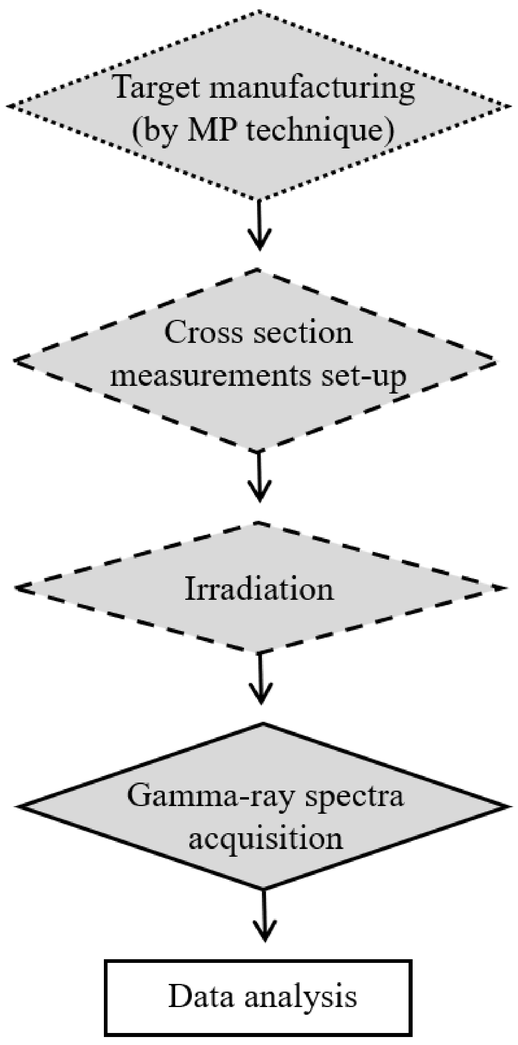
1. INTRODUCTION

Production of radionuclides for nuclear medicine is crucial for advancements in both diagnosis and therapy. ^{155}Tb stands out as a promising candidate for SPECT imaging and as counterpart of the therapeutic radionuclide ^{161}Tb in theragnostic approach [1]. This work focuses on the gadolinium target fabrication process via molecular plating (MP) and its uses to study the production and identification of activation products after proton irradiation.

2. METHODOLOGY



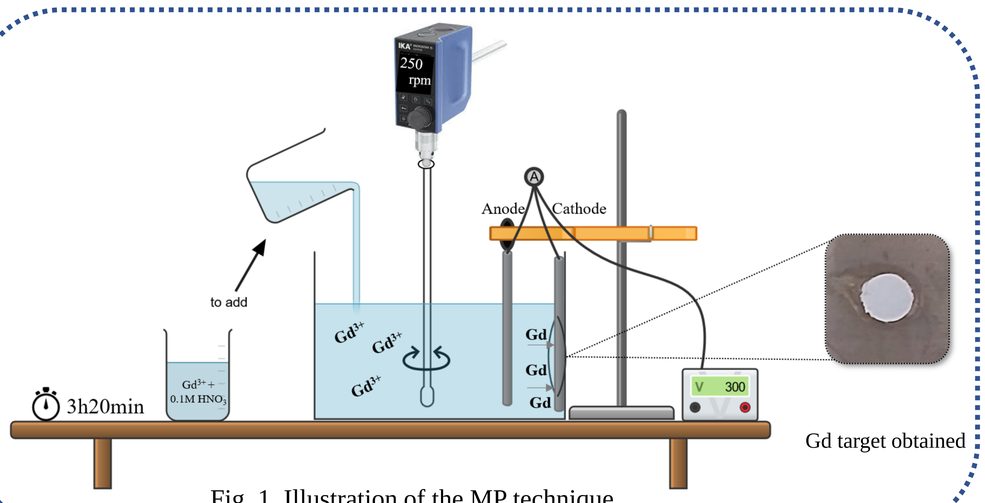


Fig. 1. Illustration of the MP technique

- Mass of Gd: 2 mg in the electrolyte solution.
- Stirring: 250 rpm.
- Substract: Ti.
- Cathode and anode: Ti and Pt.
- Current density: 10.5 $mA \cdot cm^{-2}$.
- Obtained target: 0.64 ± 0.01 cm of diameter and 1.41 ± 0.04 mg of Gd.

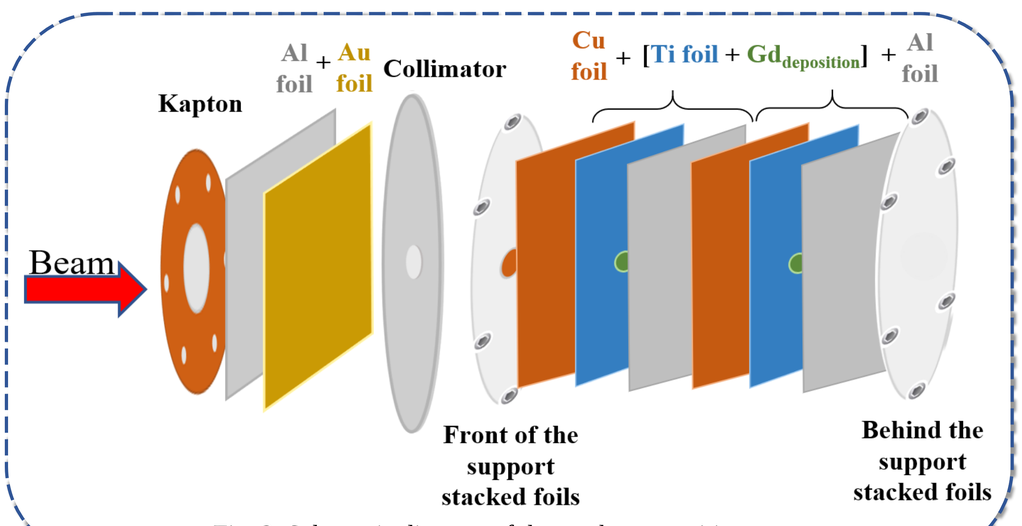


Fig. 2. Schematic diagram of the stack composition

- Nuclear reaction of interest: $^{nat}Gd(p,x)^{155}Tb$ and ^{156}Tb.
- Stacked foils technique.
- Monitor control of beam (ø = 0.9 cm) before irradiation: with Gafchromic film to control the beam homogeneity.
- Beam current: 125-150 nA.
- Irradiation time: 40-47min.
- The activities produced in targets were analyzed by HPGe detector.

3. RESULTS

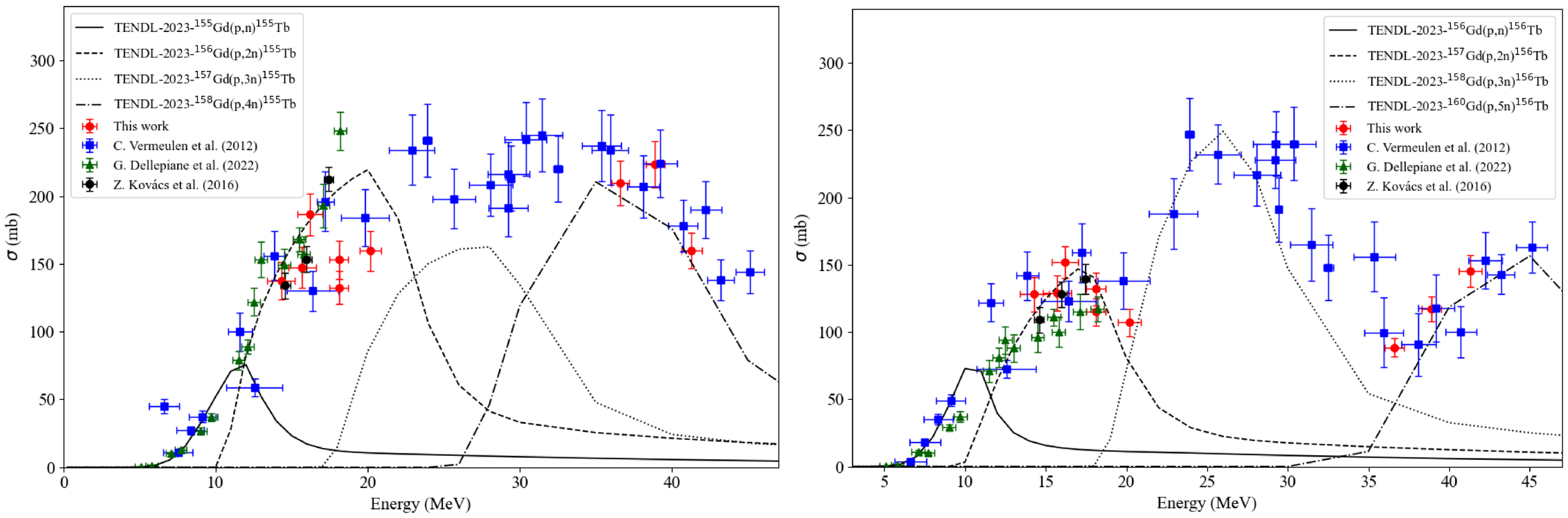


Figure 3. Excitation function of $^{nat}Gd(p,x)^{155}Tb$ and ^{156}Tb

4. CONCLUSION

Results demonstrate that MP is a viable method for producing thin, homogeneous, and adherent Gd films on Ti substrates. In comparison with previously published experimental cross sections and theoretical predictions, the measured data obtained here for several Tb isotopes show good agreement, confirming the validity and reproducibility of the adopted methodologies. The results also highlight the potential of the MP technique for producing high-quality targets for nuclear data measurements, and medical radionuclide production. Looking ahead, future works will focus on extending this methodology to enriched targets in Gd isotopes, such as ^{155}Gd and ^{156}Gd, with the aim of optimizing the production of ^{155}Tb, and reducing the co-production of undesired impurities.

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