LANTHANIDE TARGET FOILS FOR THE EXPLORATION OF TARGETED ALPHA THERAPY PRODUCTION MECHANISMS

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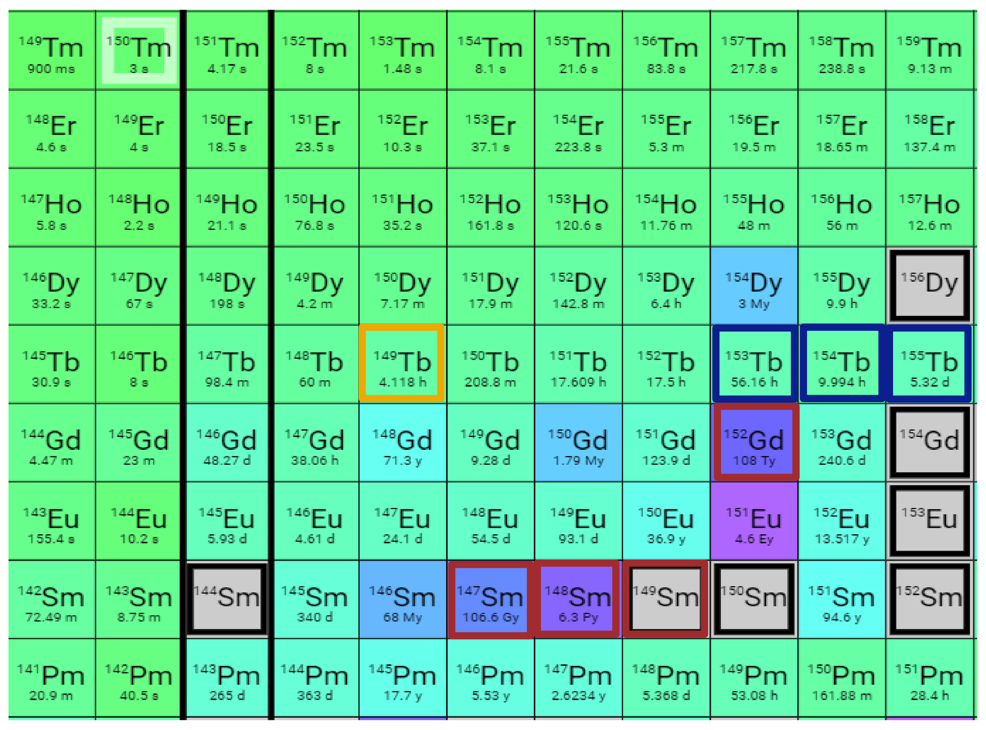
MOTIVATION

- Targeted alpha therapy (TAT) is rapidly coming to the frontiers of radiotherapeutic cancer research due to its high cell mortality rate when localized to the cancer site via a targeting agent. While radium-223, actinium-225, and astatine-211 are at the forefront of this research, all of these isotopes require separate isotopes for imaging (theragnostic pairs), since their alpha decays cannot be imaged outside of the body. A lesser known prospect for TAT is terbium-149, which decays via both positron and alpha emission, allowing it to be its own theragnostic pair, and eliminating the need for an imaging analog. However, it does not yet have a well-established production pathway via direct reaction. In order to probe potential reaction mechanisms for its production, a series of experiments will be executed which require the production of isotopically enriched samarium and gadolinium targets.

REACTION MECHANISMS

- ^{147}Sm(^{6}Li,4n)^{149}Tb – 45 MeV
- ^{148}Sm(^{6}Li,5n)^{149}Tb – 55 MeV
- ^{149}Sm(^{6}Li,6n)^{149}Tb – 65 MeV
- ^{152}Gd(p,4n)^{149}Tb – 40 MeV



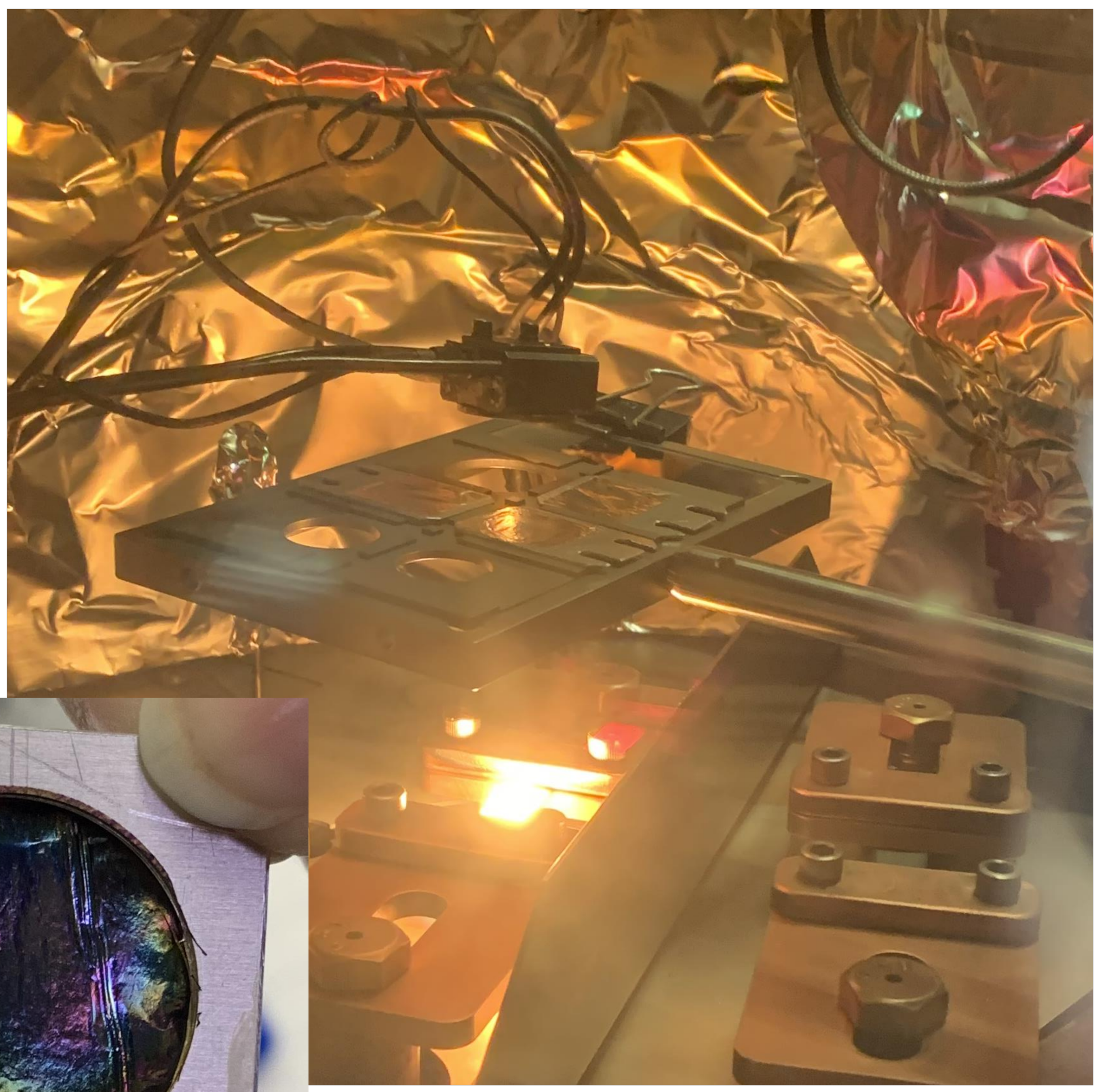
Target Nucleus

Compound Nucleus

Product Nucleus

SAMARIUM TARGETS

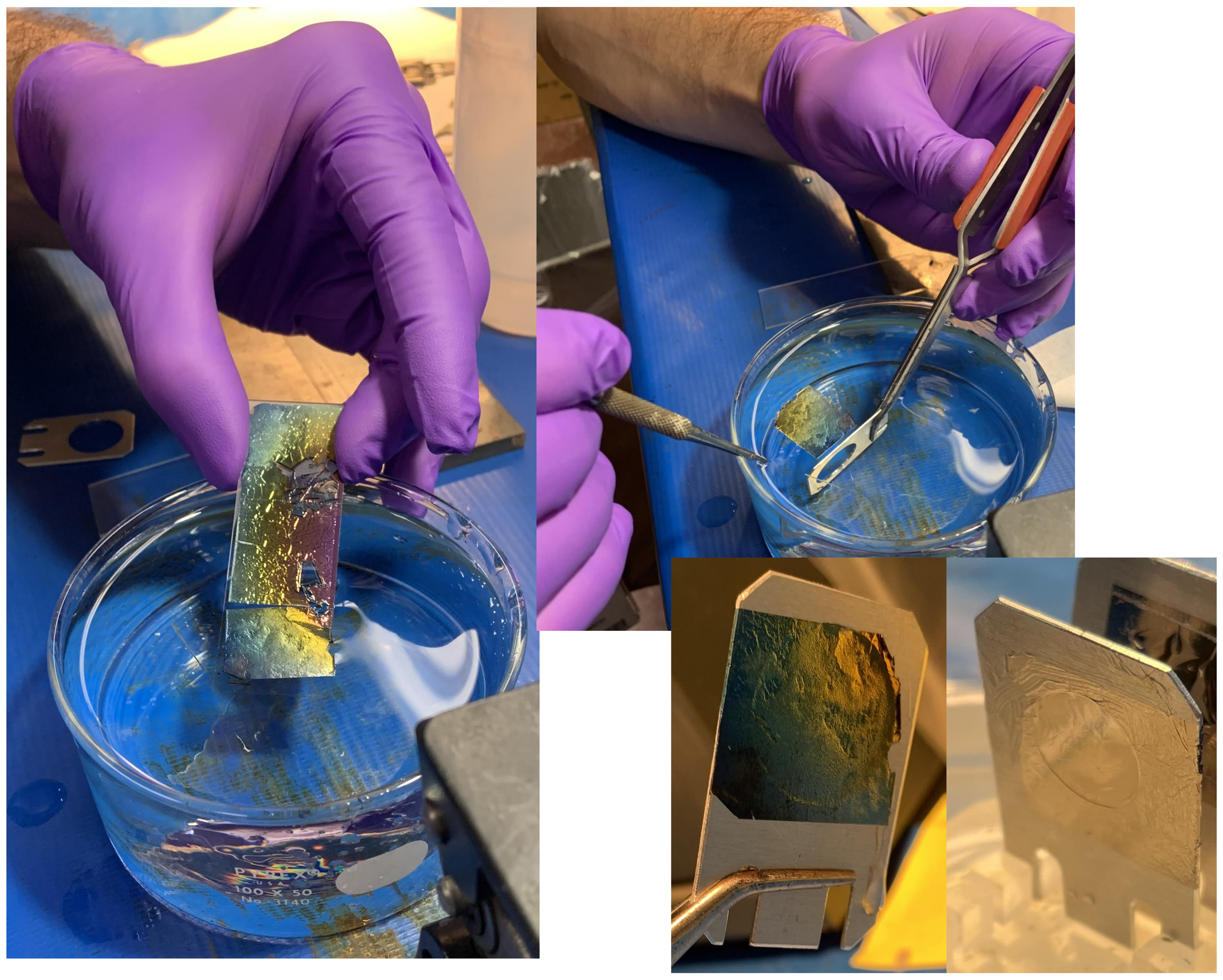
- Sm_2O_3 powder
- Low melting point lanthanide
- Vapor deposition
- 1 mg/cm^2
- Ta pinhole boat
- $3Zr + 2Sm_2O_3 \rightarrow 3ZrO_2 + 4Sm$
- Monitor heat of frame
  - < 60°C: metallic
  - > 60°C: oxidized



Aluminum Backed

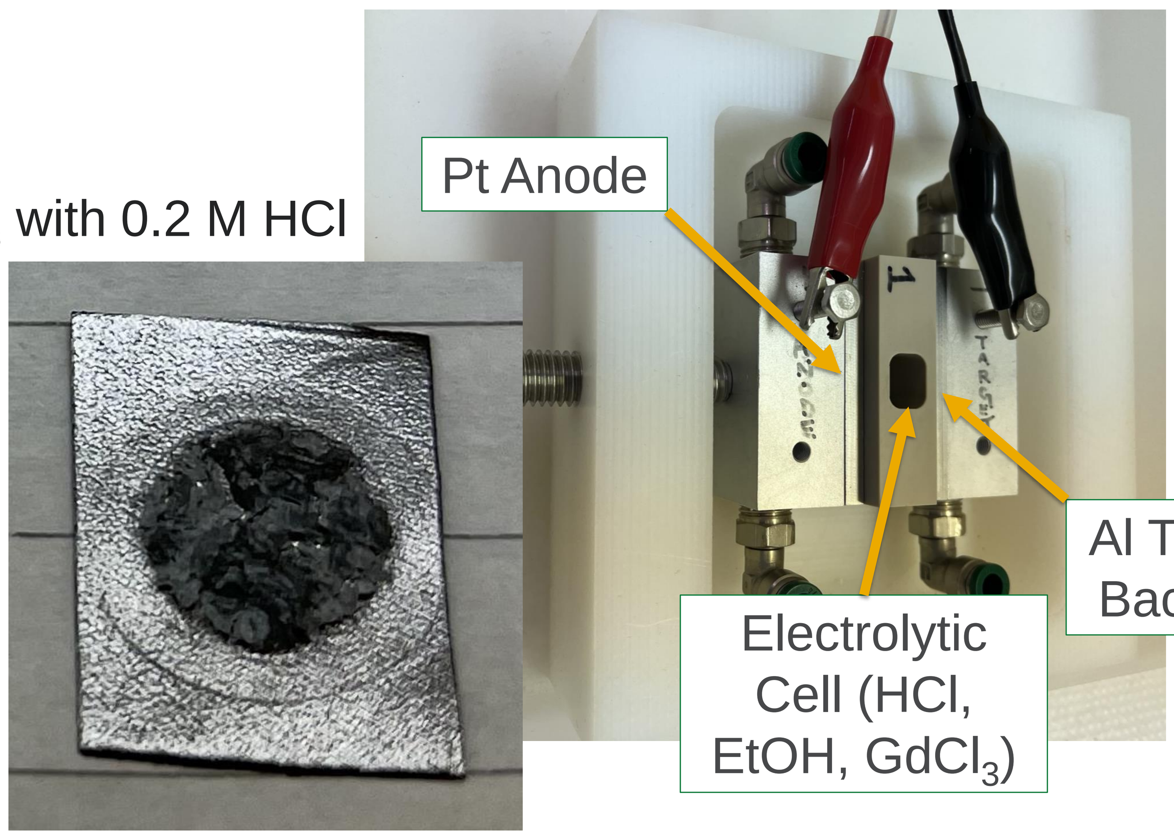
Self-Supporting

- NaCl coated microscope slides, via vapor deposition
- Vapor deposition of Sm
- Floated Sm off of slide in H_2O



GADOLINIUM TARGETS

- High melting point lanthanide
- Electroplating
- Convert Gd_2O_3 powder to $GdCl_3$ with 0.2 M HCl
- Evaporated to dryness
- Dissolved in 0.01 M HCl
- Diluted to 20 mL in EtOH
- Voltage: 10, 60, & 200 V
- Current: 2 mA
- Time: 1 hr
- Salt targets produced



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