Demonstration of the Stopping and Release of Rare Light Isotopes at NSCL-MSU Facility and Medical Isotope Production at ATLAS
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ABSTRACT
InnoSense LLC (ISL) has developed a manufacturing technology to produce refractory yttria-stabilized zirconia (YSZ) and Hafnia (HfO2) and Calcium oxide (CaO) monoliths with >50% open interconnected porosity, for use as versatile, fast-release solid catchers for rare isotopes (SCRI). These catchers are targeted to stop rare isotopes with conversion to and release as shown below.

FABRICATING CATCHERS
Nanoscale powders (YSZ, HfO2 and CaCO3) were used as starting materials. The processing steps are shown in the images below.

TESTING SOLID STOPPERS AT NSCL
• Test setup was constructed and tested at ATLAS
• First on-line test of the porous solid catchers (W/C) was conducted at NSCL using a very short-lived isotope (6He, 119 msec) in May 2018.
• Collaboration between ANL and NSCL scientists.

TARGET CHARACTERIZATION
Bismuth oxide (Bi2O3) target on 303SS or Titanium support
• Processed by spin coating here, newer method
• Adheres to substrate upon thermal cycling to 600 °C
• Retains 50–60% porosity
• Film thickness tunable from 2–80 μm

CONCLUSIONS
• The high density and large open porosity of the SCRI are ideal for capturing rare isotopes, allowing their diffusion into and release from the catcher.
• The first-generation of a catcher/heater apparatus was built and tested at both NSCL and ATLAS.
• The apparatus successfully heated samples up to ~400 °C while implanting 6He fragments at NSCL.
• Very promising first result with an “effective half-life” decreased to ~117 msec (limited by present heater) estimated at 20% release efficiency.
• Several fabricated porous catchers (oxide, tungsten, tungsten carbide, carbon) await testing on-line testing at FRIB.
• Heating the ceramic-like Bi2O3 target to 500 °C in helium atmosphere did not release 212Rn significantly. Next test is to heat in vacuum and go to higher T if necessary. (run scheduled for Sept 3–5, 2019).
• Target development continues through an ongoing SBIR Phase I (DE-SC0019587).

ABOUT INNOSENSE LLC
• Founded in 2002
• Located in Torrance, CA
• 30 full-time employees
• 11,400 sq ft. of lab & office space