

**LA-UR-17-26029**

Approved for public release; distribution is unlimited.

Title: Chemical Applications for Enhanced World Security

Author(s): Leibman, Christopher Patrick

Intended for: Web

Issued: 2017-07-19

---

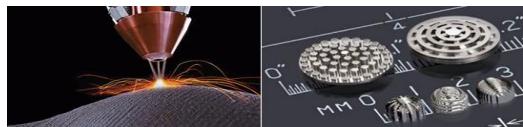
**Disclaimer:**

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

# Chemical Applications for Enhanced World Security

## BACKGROUND

- Samples for chemical analysis generally require extensive preparation *before* analyses can be performed.
- Processing time long.
- Requires significant expertise.
- LANL has developed sample processing methods for nuclear materials analysis that is fast for use by non-experts.
- New LANL methods can be performed in 3D printed devices controlled electronically.
- This integration of chemistry within 3D printed devices would be a “chemical application” for a specific analysis.



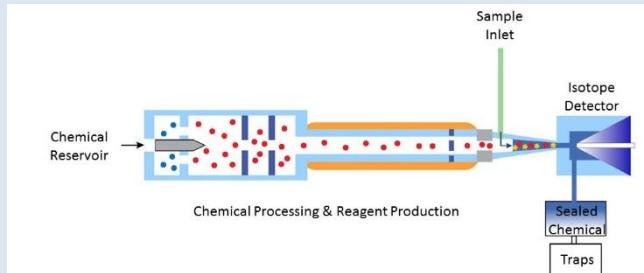
3D printing or additive manufacturing produces parts that could not be made before.

## MOTIVATION

- Reduce complexity of chemical analysis by combining chemical and physical processing steps into one package.
- Develop instrumentation that cost less and is easy to use in a field laboratory by non-experts.
- Develop this “Chemical Application” so uranium enrichment can be measured on-site, eliminating the need for radioactive sample transport.

## INNOVATION

Development of chemical processing inlet for isotope ratio mass spectrometry (IRMS) of uranium isotopes in corrosive uranium hexafluoride ( $\text{UF}_6$ ).



Chemical processing steps integrated into additively manufactured inlet for IRMS of in  $\text{UF}_6$ .

## Instrumentation for Isotope Ratio Measurement



### Conventional Laboratory Instrumentation

- \$1M - 1,600 lbs.
- Radioactive Sample Shipment to laboratory
- Expert User Operation

### Field Laboratory Instrumentation

- \$30K -40 lbs.
- No Sample Shipment
- Transparent Operation

## ANTICIPATED IMPACT

- Simplification of international treaty compliance monitoring of uranium enrichment.
- Will enhance world security.
- Reduce instrumentation cost by more than 30 times.
- Eliminate need for highly skilled operator.

## PATH FORWARD

- Develop business plan for manufacturing start-up.
- Develop chemical analysis applications for:
  - Nuclear Materials
  - Homeland Security
  - Environment
  - Industrial Process Monitoring

### Technology Readiness Level

- TRL 3
- TRL 8 within two years.

Point of Contact: Chris Leibman, PhD.  
MPA-11, 695-6060, [cleibman@lanl.gov](mailto:cleibman@lanl.gov)