

Researchers evaluate samples on a Raman microscope

## Energy Innovation Laboratory Pyrochemistry Research Capabilities

*Supporting pyrochemistry and molten salt research*

**P**yrochemistry—the study of chemical reactions at high temperatures—is important for the development of advanced nuclear technologies. In particular, researchers rely on pyrochemistry for molten salt reactors, a type of reactor where the fuel is dissolved in molten salt; and pyroprocessing, where molten salts are involved in recycling used nuclear fuel to recover valuable elements like uranium and plutonium.

The Pyrochemistry Laboratories located at Idaho National Laboratory's Energy Innovation Laboratory (EIL) play a vital role in researching molten salts for

processing used nuclear fuels and developing molten salt reactor systems. The research conducted in these laboratories is instrumental in the design and development of molten salt reactors and other innovative reactor designs.

### LAB CAPABILITIES

The labs contain gloveboxes, fume hoods, furnaces, analytical instruments, and other key pyrochemistry equipment and capabilities. These two laboratories support research and development related to:

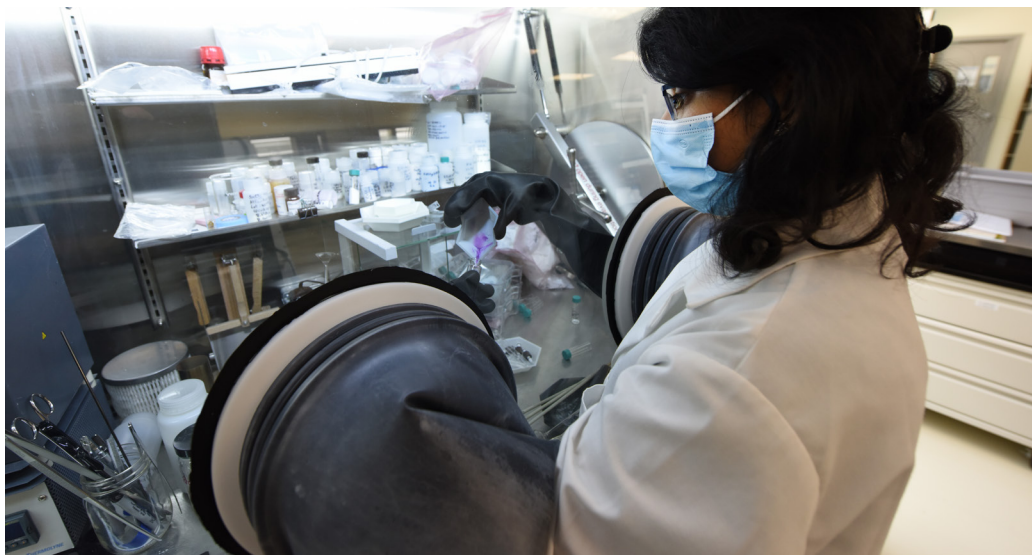
- Characterizing surrogate fuel salt (non-radioactive salts that mimic the behavior of those used in a reactor system) and other materials.

- Performing corrosion studies.
- Analytical and experimental electrochemistry.
- Nuclear waste form development.

Non-radiological methods, equipment and techniques refined and developed in these labs have been applied in radiological laboratories and hot cells across INL.

One laboratory contains multiple inert atmosphere gloveboxes used for combined spectroscopy and electrochemistry, corrosion studies on materials such as high entropy alloys, work with corrosive and hygroscopic materials, and a range of test equipment.

Researchers at the EIL pyrochemistry laboratories are helping advance molten salt reactor research



The other laboratory contains a large inert atmosphere glovebox, a natural convection molten salt flow loop within the glovebox, and a walk-in fume hood occupied by a glass and ceramic waste form development furnace.

Applications of the technologies within the EIL Pyrochemistry Laboratories range from developing molten salts for nuclear energy applications, concentrated solar energy, mining processes and tools, and chemical engineering.

#### RESEARCH FOCUS AREAS

- Materials handling in inert atmosphere gloveboxes
- Measuring the physical and thermal properties of fluids and materials
- Electrochemical analysis and process development
- High temperature spectroelectrochemistry
- Corrosion studies for novel materials such as high entropy alloys
- Studying molten salt flow loops

- Glass and ceramic waste form development and characterization
- Fluid wetting and surface tension behavior analysis
- Fluid characterization along temperature gradients
- » Concentrates contaminants with a temperature gradient and slow, vertical sample movement
- » Two heat zones
- Glass and ceramic waste form development furnace

#### KEY INSTRUMENTS:

- Three single-sided inert gloveboxes and one larger and deeper double-sided inert glovebox
- Spectroelectrochemistry furnace
  - » UV-Vis spectrometry
  - » Raman spectrometry
  - » Electrochemistry
- Potentiostat
- Simultaneous thermal analyzer
- Raman microscope
- Triple bubbler system
  - » Measures surface tension, density, and other physical properties of fluids via bubbling
  - » Insertable into furnaces for heated fluid analysis
- Reverse-Bridgman crystal growing furnace

*Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.*

#### FOR MORE INFORMATION

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