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## Materials Characterization Laboratory

The Materials Characterization Laboratory at NREL's Energy Systems Integration Facility (ESIF) research focus is the physical and photoelectrochemical characterization of novel materials. In this laboratory unknown samples are characterized by identifying and quantifying molecular species present through the implementation of a suite of analytical instrumentation and techniques. This leads to the ability to deconvolute decomposition routes and elucidate reaction mechanisms of materials through thermal and evolved gas analysis. This aids in the synthesis of next generation materials that are tailored to optimize stability and performance.

These techniques and next generation materials will have many applications. One particular focus is the stable and conductive tetherable cations for use as membrane materials in anion exchange membrane fuel cells. Another is to understand the leachant contaminants derived from balance of plant materials used in proton exchange membrane fuel cell vehicles. Once identified and quantified, these organic and ionic species are dosed as contaminants into ex/in-situ fuel cell tests, to determine the effect on durability and performance.

This laboratory also acts in support of fuel cell catalysis, manufacturing, and other related projects.

### Laboratory Specifications

- Integration of an array of analytical instrumentation to perform novel evolved gas analysis experimentation.
- A wide range of analytes can be safely tested and evolved with the expert operators and ventilated instrument enclosures.

### Application Scenarios

The Materials Characterization Laboratory will cover multiple analytical operations, with the overall goal of troubleshooting synthetic materials or process streams to improve performance. Having novel evolved gas analysis and other analytical capabilities; this laboratory provides a viable location to analyze small batch samples, whereas setting up these types of capabilities and expertise would be cost and time prohibitive for most institutions.

#### Experiments that can be performed include:

- Evolved gas analysis
- Heterogeneous catalysis
- Trace level contaminants analysis
- Catalyst characterization
- Kinetics and stability
- Hyphenated techniques
- Isotopic analysis for elucidating reaction mechanisms and decoupling chemical reactions

### Partner with Us

Work with NREL experts and take advantage of the state-of-the-art capabilities at the ESIF to make progress on your projects, which may range from fundamental research to applications engineering. Partners at the ESIF's Materials Characterization Laboratory may include:

- PEMFC industry
- Certification laboratories
- Universities
- Other National laboratories

### Contact Us

If you are interested in working with NREL's Materials Characterization Laboratory, please contact:

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### Major Laboratory Equipment

- Gas chromatography mass spectrometer with liquids, headspace, and SPME autosampler and direct insertion probe
- Thermogravimetric analyzer
- Thermal desorber to perform TG-GCMS type experiments
- Fourier transform infrared spectrometer with ATR, DRIFTS, and gas cell accessories to sample liquids, powders, solids, and gases
- Total organic content analyzers with autosamplers (5% and <50ppm sensitivities)
- Evolved gas analysis software and accessories to properly employ EGA techniques
- Mobile MS and GC residual gas analyzer

