CHEMISTRY LABORATORY FACILITY

Purpose:

To characterize through chemical testing candidate materials to be used in spaceflight related applications and to ensure safe working environment

Wet Chemistry Analysis

Sample analysis often involves the use of wet chemistry techniques such as acid digestion of solid samples or titration methods for determining analyte concentrations within a liquid sample. Most wet chemistry procedures are performed in room 1504 of Building 4612. This room is outfitted with fume hoods, special chemical storage facilities, and a variety of glassware and other items necessary for safe wet chemistry operations. Gravimetric, precipitation and colorimetric procedures are also performed in this facility. This facility also includes an extensive array of analytical balances. The Lab also maintains spectrophotometry capabilities as well.

Mass Spectroscopy

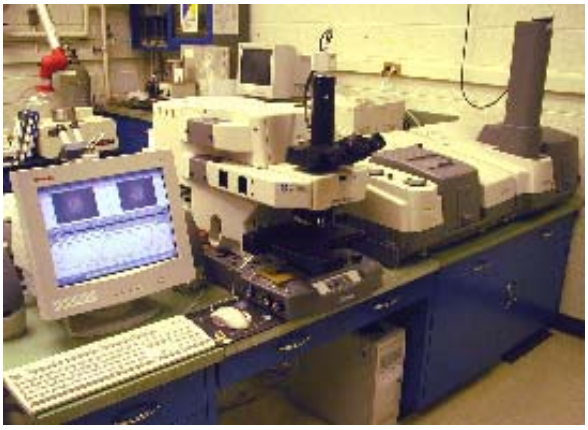
In mass spectrometry, a substance is bombarded with an electron beam having sufficient energy to fragment the molecule. The analysis of mass spectroscopy information involves the re-assembling of fragments, working backwards to generate the original molecule. Mass spectroscopy has become one of the most important instruments used in modern analytical chemistry.

In addition to operating stand-along MS systems, the Chemistry lab operates several Gas Chromatography-Mass Spectroscopy instruments (GC-MS).

The Lab also has a CEC Model 21-620 that is configured with a below atmospheric pressure inlet system. This mass spectrometer is used to measure permanent gases.

Infrared Spectroscopy

The chemistry lab recently installed a new Nicolet FTIR system. This system is comprised of three major components, a standard bench spectrometer, a microscopic FTIR component and a Raman spectrometer. The bench



spectrometer provides multiple sampling configurations, allowing transmission, reflectance, Attenuated Total Reflectance (ATR) and Specular Reflectance techniques to be employed. This system is able to analyze a wide range of organic and inorganic materials.

CHEMISTRY LABORATORY FACILITY

Thermal Analysis

Capabilities in the Lab include a Differential Thermal Analyzer (DTA), a Differential Scanning Calorimeter (DSC) and a Thermogravimetric Analyzer (TGA). Sample analysis using TGA methodologies can be accomplished using either a standard furnace or a high temperature furnace capable of heating samples up to 1500 degrees Celsius.

The Chemistry Lab also provides unique analytical capabilities by integrating both thermogravimetric and infrared analysis techniques into a single instrument. By coupling these techniques, evolving gases generated during sample decomposition in the TGA is directed into an infrared spectrometer for chemical speciation. Consequently, both thermal decomposition and chemical characterization of a material may be obtained in a single sample run, providing a more definitive and comprehensive characterization of the material.

Inductively Coupled Plasma Emission Spectroscopy (ICP)

The Chemistry Lab has a Thermo Jarrell Ash ICP system. This instrument is capable of analyzing dozens of elements within a liquid sample within a matter of minutes. Additionally, this system has a laser ablation system that allows solids to be examined without the need for sample dissolution.

Inductively Coupled Plasma / Mass Spectroscopy

In addition to operating a stand-alone ICP system, the Chemistry Lab also operates an ICP coupled with a Mass Spectrometry (ICP-MS) system. ICP-MS is the fastest growing trace element technique available today. The major reason for the technique's unparalleled growth is its ability to carry out rapid multielement determinations at the ultra-trace level.

X-Ray Analysis Techniques

The Chemistry Lab often uses x-ray spectroscopy for specimen analysis and characterization. The chemistry lab maintains two x-ray fluorescence instruments, both manufactured by Spectrace Instruments. This is a non-destructive technique that is able to analyze solids and liquids and determine concentrations down to the PPM range. The Chemistry lab facility also has a Bruker D5005 diffraction system. Both powder and solid samples may be examined in this system.

CHEMISTRY LABORATORY FACILITY

X-Ray Analysis Techniques

The Chemistry Lab often uses x-ray spectroscopy for specimen analysis and characterization. The chemistry lab maintains two x-ray fluorescence instruments, both manufactured by Spectrace Instruments. This is a non-destructive technique that is able to analyze solids and liquids and determine concentrations down to the PPM range. The Chemistry lab facility also has a Bruker D5005 diffraction system. Both powder and solid samples may be examined in this system.

Environmental Chemistry Laboratory

The Environmental Chemistry Laboratory analyzes MSFC's water, soil, air, and hazardous waste to ensure the quality of Marshall's natural environment. The Chemistry Group has direct control over environmental areas that MSFC is required by law and regulation to report.

The laboratory's inventory includes a total organic carbon analyzer for assessment of deionized water; an ion chromatograph for determining chlorides, phosphates, nitrites, nitrates, and

fluorides in water; a Microtox test system, which uses microorganisms as test reagents and biosensors; an inductively coupled plasma/mass spectrometer for sensitive trace element analysis; a gas chromatograph/mass spectrometer to analyze VOCs and semi-VOCs and a newly installed liquid chromatography system as well.

Contamination Control Laboratory

Studies are ongoing in the effort to find suitable solvents for the replacements of Freon and Perchloroethylene. These materials have long been used in large-part and tube cleaning operations here at Marshall.

NASA Materials Replacement Technology Team (NMRT2)

This team, formerly known as the NASA Operational Environment Team (NOET), is chartered to support and facilitate those materials replacement technologies that will assist NASA in achieving environmental compliance throughout all of its many endeavors.

This team is leading NASA's review of 30 Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAPS). The center of attention is on the contents of:

Title I: Volatile Organic Compounds (VOCs)
Title III: Hazardous Air Pollutants (HAPs)
Title IV: Ozone Depleting Chemicals (ODCs)

NMRT2 also closely follows research and development of replacement technologies, technology data exchanges, and supports the Aerospace Materials, Processes, and Environmental Technology Conference.

POINT-OF-CONTACT:

Robby Newton / ED36
(256) 544-7880
robby.newton@msfc.nasa.gov