



# Chemical Analysis Capabilities in the Shared Instrument Laboratory Missouri S&T Department of Chemistry

The Department of Chemistry operates a Shared Instrument Laboratory that is available to users both within and outside the campus community. Instrument training is available, after which users can operate the equipment and do analyses on their own; analyses can also be obtained as a service. For more details, visit <https://chem.mst.edu/research/depart-instr/shared-instr/> or contact the lab director, Dr. Nathan Leigh ([leighn@mst.edu](mailto:leighn@mst.edu)).

An enumeration of major instrumentation (with brief descriptions) follows.

## Optical Instruments

**Cary 5000 UV-visible spectrometer** – dual beam absorbance spectrometer with a wavelength range of 175-3300nm and an absorbance range of 0-10au. We have an integrating sphere, accessories for diffuse reflectance, and a thermostated cuvette holder.

**Cary 50 UV-visible spectrometer** – single beam instrument with a wavelength range of 190-1100nm and an absorbance range of 0-10au.

**Edinburgh Instruments FS5 spectrofluorimeter** – features an excitation and emission range of 200-800nm, has built-in filters and polarizers, and is equipped to handle both liquid and solid samples (including powders and materials on planar substrates).

**Thermo Nicolet iS50 FTIR** – workhorse instrument usually used in the mid-IR (4000-400  $\text{cm}^{-1}$ ) but can also be used in the near and far IR. The main sample compartment accommodates solid, liquid, or gaseous samples (provide your own gas cell) and we have accessories for diffuse reflectance, specular reflectance, and attenuated total reflectance (ATR). It has a built-in single-bounce ATR; this popular accessory eliminates nearly all sample preparation and makes for easy data acquisition.

**Jasco P-2000 polarimeter** – digital polarimeter measures optical rotation at the 589nm sodium line.

## Nuclear Magnetic Resonance

**Magritek Spinsolve Carbon NMR** – a benchtop NMR with a permanent magnet which gives it the performance of a ~43MHz system. While the resolution isn't sufficient for complicated molecules, the instrument is capable of proton, carbon, and fluorine experiments, and will do single and multidimensional analyses.

Please note that other NMR instruments are available in the NMR Institute hosted by the Department of Chemistry; see <https://chem.mst.edu/research/nmr-institute/> for details.

## Chromatography

**Thermo Vanquish HPLC** – this instrument can operate either isocratically or with a binary gradient, with an ultra-high pressure pump and flow rates from 0.001-1.5mL/minute. It is configured for reversed-phase chromatography and has an autosampler with cooling capabilities, a column oven, and a diode-array detector. Users must provide their own columns.

**Shimadzu QP-2020 GCMS** – has an autosampler that can do liquid and headspace injections as well as solid-phase microextraction (SPME, users provide their own fibers). The instrument has two injectors – one for a capillary column that leads to the mass spectrometer, and another for a wide-bore column leading to a thermal conductivity detector. (The capillary column is a 30m low-bleed DB5; widebore column must be supplied by the user.) The single-quadrupole mass analyzer has a range from m/z 10-1050 and can operate in full scan and selected-ion monitoring modes.

**Varian CP-3800 GC** – has a split/splitless injector and a flame ionization detector. It is currently equipped with a 30m DB-5 capillary column, but users are welcome to provide their own.

## Thermal Analyses

**TA Instruments Q500 thermogravimetric analyzer** – this TGA has a furnace range from ambient to 1000°C and can employ a variety of gases to purge the furnace during operation. Sample sizes up to 200mg can be accommodated. Users must provide their own sample pans.

**TA Instruments Q2000 differential scanning calorimeter** – has a chiller for sub-ambient operation and is capable of modulated experiments. Users provide their own sample pans; samples must not degrade/decompose within the temperature range of interest.

**Exeter Analytical CE-440 CHN analyzer** – the instrument is capable of determining the percent composition of carbon, hydrogen, and nitrogen in samples via a combustion process. Samples must be solids or non-volatile liquids. (Volatile liquids could be analyzed, but a hermetic capsule sealer is required.) With careful technique, the accuracy of the measurement is better than +/- 0.3%.

## Other Apparatus

**Sartorius ME5 microbalance** – accurate to the microgram, with a capacity of as much as five grams (with reduced precision). It is available for weighing samples for the TGA, DSC, and CHN analyzer, as well as for other applications as needed.

**Dymax UV curing oven** – this high-intensity, broad-spectrum UV oven is marketed for curing applications but is also useful for exposure testing. It features a 400W UV lamp and a manual shutter system.

## Fee Schedule for Commercial Clients

<b>Instrument</b>	<b>Standard Rate (per hour)<sup>(1)</sup></b>	<b>Assisted Use (per hour)<sup>(2)</sup></b>
Cary 5000 UV-visible spectrometer <sup>(3)</sup>	\$45.00	\$107.50
Cary 50 UV-visible spectrometer <sup>(3)</sup>	\$30.00	\$92.50
Edinburgh Instruments FS5 spectrofluorimeter <sup>(3)</sup>	\$45.00	\$107.50
Thermo Nicolet iS50 FTIR	\$55.00	\$117.50
Jasco P-2000 polarimeter	\$25.00	\$87.50
Magritek Spinsolve Carbon NMR <sup>(4)</sup>	\$25.00	\$87.50
Thermo Vanquish HPLC <sup>(5)(6)</sup>	\$62.50	\$125.00
Shimadzu QP-2020 GCMS <sup>(6)</sup>	\$82.50	\$145.00
Varian CP-3800 GC <sup>(6)</sup>	\$30.00	\$92.50
TA Instruments Q500 thermogravimetric analyzer <sup>(7)</sup>	\$45.00	\$107.50
TA Instruments Q2000 differential scanning calorimeter <sup>(7)</sup>	\$50.00	\$112.50
Exeter Analytical CE-440 CHN analyzer	\$87.50	\$150.00
Sartorius ME5 microbalance <sup>(8)</sup>	\$12.50	\$75.00
Dymax UV curing oven	\$25.00	\$87.50

### Notes

- 1) The standard rate applies to trained users only.
- 2) The assisted use rate applies whenever lab personnel help an untrained user who is present in the lab, or when lab personnel perform analysis as a service.
- 3) Users provide their own cuvettes, unless other arrangements are made in advance.
- 4) Users provide samples in their own tubes, unless other arrangements are made in advance.
- 5) Users provide their own column and eluents unless other arrangements are made in advance.
- 6) Users prepare their own samples in compatible sample vials unless other arrangements are made in advance.
- 7) Users provide their own sample pans unless other arrangements are made in advance.
- 8) There is no separate charge for the microbalance when it is used to prepare samples for TGA, DSC, or CHN analysis.

### Policies and Details to Keep in Mind

1. Instrument time is reserved and billed in half-hour increments; reservations are required for use.
2. All use is subject to instrument availability (and personnel availability where applicable).
3. Users will be charged for their reserved time plus any additional time used.
4. Business hours are 8am-5pm. Cancellations made at least two business hours before the reservation slot will not incur charges. Cancellations made less than two business hours in advance, as well as “no shows”, will result in a user charge at half the rate for any time that the instrument spends idle during your reservation period.
5. Off-campus users do not have access to the lab outside of business hours.