SERVICES

Customers of the MSF have access to a wide range of computing and data-handling facilities for acquiring, manipulating, analysing, storing, and distributing spectroscopic data. Data may be stored locally in a variety of standard electronic formats including magnetic tape and disks, CD-ROM, and DVD. The data may also be distributed to users via the computer networks and MSF Internet server (www.msf.rl.ac.uk).

The MSF maintains mechanical, brazing, glass-blowing, and electronics workshops, and there is access to a wide range of facilities and expertise on the RAL campus and in the local area.

MSF staff offer advice, training, and consultancy, in particular in the following areas:

- Experimental and analytical methods of infrared, visible, and ultraviolet spectroscopy.
- Laboratory and field spectroscopy and optical remote sensing applications.
- Spectroscopic software development.
- Spectrometric, optical, vacuum, gas-handling, electronic, and cryogenic equipment design and construction.
- Precise absolute temperature, humidity, and pressure measurement and calibration.
- Reactive chemical synthesis, sample handling and purification.
- Data acquisition, archiving, and distribution.

APPLICATIONS

Spectral data acquired at the MSF have applications in many areas including:

- Satellite-based remote sensing and aeronomy.
- Industrial manufacture and processing.
- Atmospheric chemistry and physics.
- Instrument calibration.
- Environmental surveying.
- Meteorology, radiation, and climate studies.
- Pollution monitoring and control.
- Military and defence.
- Astronomy and planetary science.

ACCESS TO THE MSF

NERC customers

The MSF is funded primarily by the UK's Natural Environment Research Council (www.nerc.ac.uk). Facility time is made available to research projects that fall within the NERC environmental science remit through a straightforward application procedure - there is no direct charge to successful applicants for MSF time. UK scientists who already have NERC or other funding for appropriate projects, or who wish to carry out feasibility studies, should complete and submit the NERC MSF Application Form (available in Word97 and Adobe PDF formats from www.sstd.rl.ac.uk/msf). It is recommended that you discuss your application with the Facility staff prior to completing the form.

Other customers

MSF time may be purchased directly by industry, government agencies, and other organisations. These contractual arrangements respect the clients' need for confidentiality. Spectral data and information can also be provided through similar arrangements. The MSF also participates in EU research programmes. Please contact the MSF staff to discuss your specific requirements and for a quotation.

FURTHER INFORMATION

To discuss your requirements or arrange a visit to the MSF, please contact:

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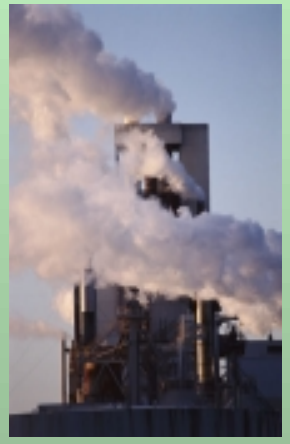
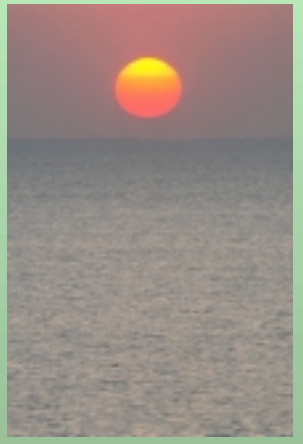
Msfbr.doc; September 2000

NERC SCIENTIFIC SERVICES

CLRC NATURAL ENVIRONMENT RESEARCH COUNCIL

RAL Molecular Spectroscopy Facility





INTRODUCTION TO THE MSF

The Molecular Spectroscopy Facility (MSF) at the Rutherford Appleton Laboratory (RAL) provides world-class scientific equipment and support for infrared (IR), visible, and ultraviolet (UV) spectroscopy. The MSF laboratories are used by many UK and international academic and industrial customers in a wide range of research and development programmes. Qualified staff from the internationally-respected Space Science and Technology Department at RAL provide the necessary level of scientific and technical support, training, and facility development to meet the needs of all MSF customers.

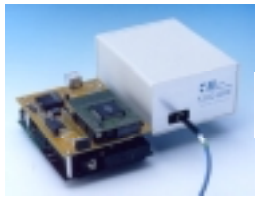
SPECTROMETERS

The spectrometric heart of the MSF consists of two high-resolution Fourier transform spectrometers (FTSs) and three high-sensitivity multi-channel spectrometers. These provide broadband measurements of optical absorption, emission and scattering covering the IR to UV regions, from 10 cm^{-1} (1 mm) in the far-IR to 55,000 cm^{-1} (180 nm) in the deep-UV. Laser-safe areas in the MSF permit the use of laser devices for spectroscopy or optical alignment.

Fourier transform spectrometers

The Bruker IFS 120HR FTS *(right)* has a maximum optical path difference of 6 metres and achieves a spectral resolution of 0.0015 cm^{-1}, equivalent to a resolving power of more than 1 million in the infrared. This instrument is particularly appropriate for studying the detailed spectra of gases and vapours. Time-resolved measurements can be made on the milli- to micro-second (10^{-3} to 10^{-6} s) timescale. The Bruker IFS 66v/S FTS instrument *(below)* is more suitable for spectroscopy of solid, liquid and aerosol samples where the maximum resolution of 0.12 cm^{-1} is usually adequate. This instrument is also portable for field measurements. Both FTS instruments are controlled by fully-networked personal computers and may be purged or operated under vacuum. Upgrade options include step-scan, FT-Raman, FT-microscopy, FT-NIR, nanosecond (10^{-9} s) time-resolved, photoacoustic, and reflectance spectroscopy.

Multichannel spectrometers

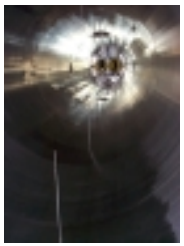


The MSF's three high-sensitivity fibre-optic miniature spectrometers allow measurement of low intensity signals at near-IR to UV wavelengths, fully covering the range 200 to 1100 nm, with time resolution of up to 3 milliseconds. Two CCD spectrometers cover this wavelength range at 0.6 nm resolution and a third diode-array spectrometer operates between 350-850 nm at 1.2 nm resolution.

SAMPLE CELLS

The MSF spectrometers are optically interfaced to a wide range of temperature-variable spectroscopic cells. These provide a range of optical path-lengths through the sample over five orders of magnitude, from 1 mm to 1 km. The cells are built of stainless-steel or glass, allowing studies of corrosive or reactive samples. The optical components of the cells are readily exchanged for optimum performance at the wavelengths of interest. All cells can be configured with appropriate temperature, pressure, and humidity sensors for automatic data acquisition, and various systems for sample handling and synthesis are available.

LPAC



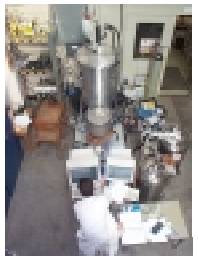
The long path-length absorption cell (LPAC) at RAL is a 9-metre long stainless-steel vessel *(below right)* containing multi-pass reflective optics *(left)* for broadband high-resolution spectroscopy at long optical path-lengths from 32 metres to over 1 km. The cell temperature, logged automatically to computer, can be controlled at any point between 190 and 320 K, and cooling to 77 K is also possible.

A state-of-the-art high-vacuum system ensures the LPAC and all external optical paths can be fully evacuated.

SPAC

The short path-length absorption cell (SPAC) contains multi-pass reflective optics for broadband high-resolution spectroscopy at intermediate path-lengths from 1.6 to 20 metres. The cell temperature can be set at any point between 190 and 373 K and gas pressures as high as 500 kPa (5 bar) can be safely contained inside the stainless-steel vessel.

Aerosol cell



A 75 dm^3 volume cell is available for generating and studying the chemical, physical, and optical properties of a wide range of aerosol systems in the laboratory. The temperature of the aerosol particles may be varied from 180 to 350 K, allowing different phases (amorphous and crystalline solid, liquid) and gas-phase components to be studied.

OTHER EQUIPMENT

- Single-pass spectroscopic cells with optical path-lengths from 1 mm to 26 cm, including a collision-cooling cell for studies of cryogenically super-cooled gases and vapours.
- Broadband light sources and housings including mercury discharge (far-IR/UV), globar (IR), tungsten (near-IR/visible), LED's (near-IR to near-UV), xenon arc (UV), and deuterium (deep-UV).
- Tuneable diode laser (TDL) spectrometer.
- Helium-neon and diode laser alignment devices, laser tables, and optical components/mounts.
- Baratron capacitance gauges (10 torr to 5 bar full-scale) and humidity sensors.
- Mass-flow and automatic valve controllers.
- Electronic test/diagnostic equipment, e.g. digital oscilloscopes, and various electrical power supplies.
- Fume hoods, rotary, diffusion, and turbo-molecular vacuum pump systems, and vacuum test equipment.