

### High quality data analysis

With over a hundred years of dedication to excellence in research and teaching, the School of Chemistry is one of the UK's leading chemistry departments. At its heart, the Centre for Chemical and Materials Analysis offers an extensive range of high quality analytical facilities to both the academic and commercial sectors.

Our services enable small-to-medium sized enterprises to have access to state-of-the-art equipment and a high level of expertise at a reasonable cost across the following areas:

- Mass Spectrometry
- NMR Spectroscopy
- Chromatography
- Elemental Analysis
- X-Ray Diffraction
- X-Ray Fluorescence Spectroscopy
- Raman Microscopy
- UV-Vis, NIR, FTIR and Fluorescence Spectroscopy
- Particle Size Analysis
- Thermogravimetric Analysis
- Microwave Reactions
- Metal Evaporation
- Magnetic Resonance Micro-imaging

### Contact us

The team in the Centre has vast cumulative experience and expertise within the field of chemical and materials analysis providing the very highest quality of data to academics and students in both research and teaching.

With our excellent facilities and high level of expertise we are able to offer an efficient, quality service to commercial organisations, which can be adapted to meet individual needs and timescales.

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School of Chemistry

## Centre for Chemical and Materials Analysis

High quality analytical services



UNIVERSITY OF  
BIRMINGHAM

## Centre for Chemical and Materials Analysis



### X-ray Diffraction

The X-ray Diffraction facility is equipped with seven state-of-the-art diffractometers offering single crystal, solid and powder X-ray diffraction.

### Powder X-ray Diffraction

- High-resolution data for ambient temperature materials characterisation and advanced structure determination and refinement.
- Variable-temperature data (80 K – 1000 K) with rapid collection times for time-resolved studies
- Capillary system for air-sensitive samples
- Two wavelengths available; copper and cobalt

### Single Crystal X-ray Instruments

- Rapid data collection and structure determination
- Low temperature data collection (from 80 K)
- Dual wavelength; molybdenum and copper

### Mass Spectrometry

The Mass Spectrometry laboratory offers an extensive range of techniques and ionisation methods with a fast turn around of results.

- Electron Ionisation (EI), Chemical Ionisation (CI) and GC/MS
- LCMS, Electrospray (ES)/APCI/ASAP/ESCI
- Accurate Mass Measurement
- Matrix-Assisted Laser Desorption Ionisation (MALDI)

### NMR Spectroscopy

The Nuclear Magnetic Resonance facility is equipped with five spectrometers for a fast, round-the-clock operation.

- Rapid turn around of routine  $^1\text{H}$ ,  $^{13}\text{C}$ ,  $^{19}\text{F}$  and  $^{31}\text{P}$  spectra run completely in automation
- More demanding multi-pulse experiments, including nOe work, undertaken following discussion with our expert, widely experienced staff
- Dynamic, variable temperature experiments in the range of  $-95\text{ }^\circ\text{C}$  to  $+110\text{ }^\circ\text{C}$
- Multinuclear NMR, including a range of inorganic nuclei

### Chromatography

The Chromatography laboratory has a wide range of analytical instrumentation and offers the following separation techniques:

- Gas chromatography
- Chiral HPLC
- Analytical HPLC
- Semi Preparative HPLC
- Preparative HPLC

### Elemental Analysis

Elemental Analysis can be used to analyse for carbon, hydrogen, nitrogen and sulfur in a wide range of substrates.

- Organic compounds
- Pharmaceuticals
- Organometallics
- Petrochemicals
- Carbides and nitrides
- Polymers

## Centre for Chemical and Materials Analysis



### Raman Microscopy

Spatially resolved information on structure, bonding, constituents and electronic structure of a wide variety of functional and structural materials.

- Equipped with 532 and 633 nm lasers
- Differentiation of polymorphs
- Chemical mapping
- Detection and monitoring of stress in silicon based microelectronics
- Identification of high-temperature and high-pressure treated diamonds

### X-ray Fluorescence Spectroscopy

XRF can be used to determine the elemental composition of samples, including solids, powders and liquids. It is able to detect elements from sodium through to uranium.

- Wavelength Dispersive XRF system
- Elemental analysis of materials, predominantly inorganic solids and powders
- Optimised for detecting and quantifying elemental components at major, minor and trace (ppm) levels
- Capable of handling small sample sizes (<1g)
- Qualitative, fully quantitative and standardless analyses

### UV-Vis Spectroscopy

Identification of materials by absorption spectroscopy.

- Wavelength: 190 – 1100 nm
- Excellent noise performance and reproducibility.
- 1.5 nm fixed spectral bandwidth
- High scan rates to scan the whole range in 3 seconds
- Ideal for photosensitive samples

### UV-Vis-NIR Spectroscopy

Advanced optical system equipped with PbS NIR detector for excellent noise and linearity performance to near infrared. Double monochromator to minimize photometric noise and stray light, providing excellent resolution.

- Wavelength range: 175 – 3300 nm
- Advanced electronics design to measure beyond 8 Abs
- Solutions, solid samples and thin films
- Diffuse reflectance accessory
- Peltier stage for variable temperature experiments
- Oxford cryostat for temperatures up to liquid N<sub>2</sub>

### FTIR Spectroscopy

Records vibrational spectra. Provides information on the chemical constitution of samples and the nature of bonds present in the sample.

- Optimised for powder samples
- Environmental chamber for the measurement of air sensitive samples

### Fluorescence Spectroscopy Instrumentation

State of the art fluorescent spectrometers with high sensitivity and resolution for full evaluation of fluorescent properties.

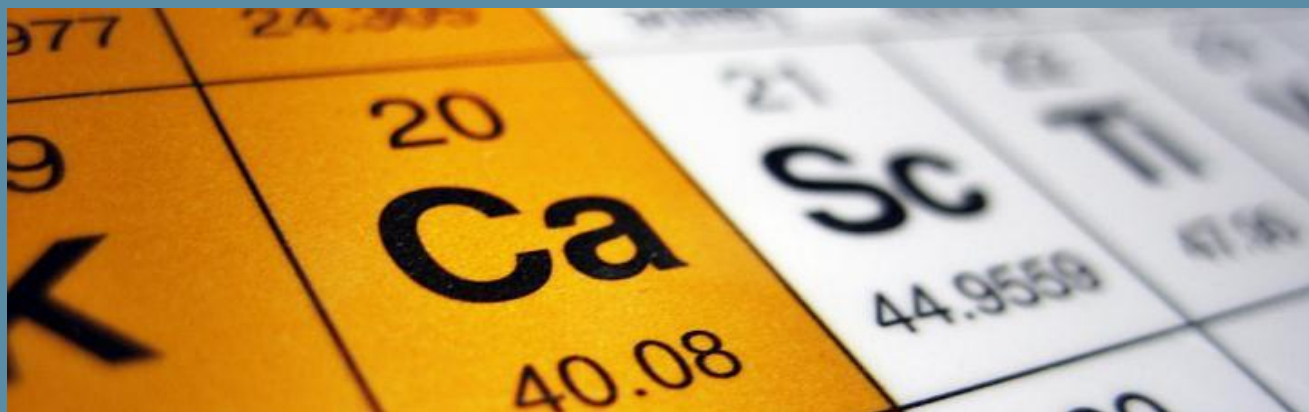
- Visible/Near Infrared steady state detection range 400 - 1700 nm
- Time resolved measurements using ND YAG laser and picosecond pulsed diode lasers
- Powder, film or liquid samples
- Option of variable temperature measurements
- Inverted epifluorescence microscope for imaging of different types of samples

### Thermogravimetric Analysis

Thermal analysis of materials up to temperatures of 1350 °C in controlled atmospheres. Mass change and calorimetric effects can be monitored simultaneously. The equipment is linked to a mass spectrometer which allows immediate analysis of evolved gases.

- Temperature and composition of evolved gases
- Mass change
- Information on phase changes even when no mass change occurs

## Centre for Chemical and Materials Analysis



### Metal Evaporator

Evaporator for gold, aluminium, silver, chromium, copper and germanium to prepare coated surfaces. Equipped with the ability to select sources during processing enabling in situ multilayer formation .

- Deposition is monitored by quartz crystal microbalance
- Deposition rates 0.01 or 0.001 nm s<sup>-1</sup>

### Magnetic Resonance Micro-imaging

The magnetic resonance microscopy (MRM) laboratory is equipped with a Bruker DMX-300 spectrometer.

- 7T wide bore superconducting magnet
- Micro2.5 and WB40 imaging probes (sample size ≤25 mm)
- DIFF30 diffusion probe (sample size < 10 mm)
- Flow visualisation (flow velocities accessible: 0.1 mm s<sup>-1</sup> - 0.1 m s<sup>-1</sup>)
- Molecular self-diffusion measurements (diffusion coefficients accessible > 10<sup>-14</sup> m<sup>2</sup> s<sup>-1</sup>)

A range of nuclei can be studied, including <sup>1</sup>H, <sup>19</sup>F, <sup>7</sup>Li, <sup>31</sup>P, <sup>27</sup>Al. Samples can be studied under shear using a Bruker Rheo-NMR Accessory with stepper motor and gear box.

### Zeta Potentiometer and Molecular Weight Characteriser

Measures hydrodynamic size and zetapotential.

- Particle size: 0.6 nm to 7 μm
- Zetapotential: -100 mV to +100 mV
- Concentration 0.001 to 40%
- pH 1 to 13

### Nanoparticle Characterization

Analysis of the size distribution and concentration of all types of nanoparticles from 10nm to 2000nm in diameter.

- Particles illuminated by 40 mW 640 nm laser tracked and quantified by software
- Size range typically 10 – 1000 nm
- Sample volume 0.3 ml
- Polydisperse and multimodal systems identifiable

### Microwave Reaction Station

Microwave reactor for chemical syntheses, including polymers and peptides.

- 10, 35, 80 ml capacity at 21 bar, or 125 ml at atmospheric pressure
- Hydrogenation accessory

### Contact us

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