Facilities and instrumentation in the School

In recent years, more than £10M has been invested in the infrastructure of the School of Chemistry. Teaching and research laboratories have been refurbished and re-equipped to give our students access to facilities and instrumentation that are among the best in the UK. Since learning how to use state-of-the-art analytical tools is a vital part of your training for a future career in research or in the chemical industry, instruction in the theory behind these techniques, as well as using them in practice, forms an integral part of our undergraduate degree programmes.

Mass Spectrometry (/facilities/chemical-analysis/mass-spec/index.aspx)

NMR Spectroscopy (/facilities/chemical-analysis/nmr-spectroscopy.aspx)

Magnetic Resonance Imaging (/schools/chemistry/undergraduate/magnetic-resonance-imaging.aspx)

Chromatography (/facilities/chemical-analysis/chromatography.aspx)

Facilities for studying surfaces and advanced materials

The College of **Engineering and Physical Sciences (/university/colleges/index.aspx)** has recently benefited from a major investment of over £4.6M, the majority of which has come into the School of Chemistry to support the study of advanced materials through the **Birmingham Science City (http://www.birminghamsciencecity.co.uk/)** initiative, funded by **Advantage West Midlands (http://www.advantagewm.co.uk/)**. Two major projects have been supported:

1. "Creating and Characterising Next Generation Advanced Materials"
2. "Innovative Uses of Advanced Materials for a Modern World"

Research groups in the School are exploiting these facilities for the development of new materials for advanced applications, such as fuel cell components, battery materials, sensors, biomaterials, electronic and magnetic materials. These state-of-the-art facilities not only allow the study of the composition and structure of materials, but are also being used to characterise their electrochemical, photophysical and rheological properties.

Importantly, all these facilities are used extensively during research projects in Materials Chemistry and provide our students with experience of the latest characterisation technologies that are being used to probe the physicochemical and morphological properties of advanced materials. These facilities are used extensively during undergraduate research projects in Materials Chemistry. The instrumentation can be classified into the following.

Open all sections

[1] Bulk Structural Characterisation

X-ray diffraction

This is the most powerful solid-state method for determining details of crystal and molecular structures. Our excellent facilities for X-ray diffraction experiments on both powder samples and single crystal samples include two single crystal X-ray diffractometers and four powder X-ray diffractometers. These instruments allow experiments to be carried out under a range of different conditions, including extremes of high and low temperatures.

X-Ray Fluorescence

This technique is used to determine the composition of materials down to levels of one part in a billion parts (ppb).

Thermal Analysis coupled to Mass Spectrometry (TGA-MS)

This technique allows the determination of gaseous degradation products upon heating materials.

Raman spectroscopy

This technique is similar to Infra Red spectroscopy and provides further details on functional group characterisation.

[2] Surface Analysis

Ellipsometry

This technique is used to analyse the thicknesses of surfaces from several 100 nm down to sub 1 nm length scale.

Atomic Force Microscopy (AFM)

This technique allows the topography (for example surface roughness) and phase (for example physical nature) to be mapped spatially to sub 1 nm resolution in the z – axis and ~1 nm in the x-y plane.

X-ray Photoelectron Spectroscopy (XPS)

The chemical composition of a surface varying from a few 10s of nanometres to microns can be evaluated with this technique.

Contact Angle Goniometry

Surface wettabilty can be measured with this technique and related to the surface energy, which is important for considering the compatibility of two surfaces and in corrosion studies.

[3] Nanoparticle Analysis

Light Scattering for Size Analysis

Assessing the size of nanoparticles is difficult as they are smaller than the wavelength of light. However, by determining how a colloidal solution of particles scatters light it is possible to assess the size of the particles in the solution.

Zeta Potentiometry

Nanoparticles have a tendency to aggregate, and therefore it is important to be able to assess this tendency. Zeta potentiometry allows the measurement of charge of a colloidal dispersion of nanoparticles, and make this assessment.

Nanosight

This instrument allows actual ‘visualisation’ of nanoparticles by tracking the scattered light from the particles.