

## School of Chemistry

### Aims and Objectives: Session 2022-2023

#### Module CH3715: Introduction to Analysis of Materials

**Duration:** 15 hours

**Lecturer:** Dr R. T. Baker\* and Professor W. Zhou

(\*Module Convenor)

**Aims:** The aim of this course is to give an introductory treatment to the main X-ray, ion beam, electron, electromagnetic spectroscopy, thermochemical and diffraction methods used in the analysis of materials. Methods which give information on the crystal structure, elemental composition and oxidation states of a sample will be covered. For each technique, the principles of operation, the instrumentation required, the information provided and the methods of data analysis will be covered. The techniques will be compared and contrasted in order to develop an understanding of the interactions between the atoms of a sample and electron beams, X-rays and other forms of radiation.

**Objectives:**

The students will gain an understanding of the underlying principles, operating procedures and information provided by the following groups of materials analysis techniques. They will also be able to interpret the spectra, images and diffraction patterns obtained.

1. Powder and single crystal X-ray Diffraction (brief review only).
2. The Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM) and the associated techniques of Electron Diffraction, Energy Dispersive Spectroscopy (EDS) and Electron Energy Loss Spectroscopy (EELS).
4. X-ray emission (EDS, X-ray Fluorescence (XRF) spectroscopy) and X-ray absorption methods (Extended X-Ray Absorption Spectroscopy, EXAFS and X-ray Absorption Near Edge Spectroscopy, XANES).
6. Solid State NMR, IR, u.v.-visible and Raman spectroscopies.
7. X-ray Photoelectron Spectroscopy.
8. Thermochemical methods including Thermogravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC).
9. Atomic Force Microscopy.

Finally, the necessity to use a number of techniques together to obtain a comprehensive description of a specific sample will be stressed since each method has advantages and limitations.