

CH914-10 Electrochemistry and Sensors

26/27

Department

Chemistry

Level

Taught Postgraduate Level

Module leader

Julie Macpherson

Credit value

10

Module duration

2 weeks

Assessment

50% coursework, 50% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This module provides a grounding in the fundamentals of electrochemistry, electroanalytical techniques and sensor technology. The module encompasses potentiometric methods, voltammetric/amperometric techniques, microfluidic/flow devices. Electrochemistry aspects draw on Warwick's major strengths in this area and include developments in ion selective electrodes, electrode kinetics and mass transport and key techniques, such as linear sweep and cyclic voltammetry, hydrodynamic electrodes, stripping voltammetry, ultramicroelectrodes and array devices. Lectures and problems classes are supplemented by laboratory sessions which provide students with practical hands-on experience.

[Module web page](#)

Module aims

This module focuses on advanced theoretical and practical aspects of modern electroanalytical and related sensor techniques, covering both theory and practice. Many of the techniques covered in lectures are reinforced in the laboratory, where students are trained in good laboratory practice and assessment of experimental error. Over the course of this module, students complete a set of

laboratory experiments which cover key concepts, and which emphasise data evaluation and analysis to determine analyte concentrations and physicochemical properties, such as diffusion coefficients.

Topics covered include: equilibrium techniques (pH measurement, ion selective electrodes); dynamic electrochemistry and kinetics; cyclic voltammetry and potential step methods; hydrodynamic electrodes; microelectrode techniques; biosensors; new electrode materials; introduction to electrochemical scanned probe microscopes; array techniques, lab-on-a-chip concept and on-line analysis.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Lectures cover the following subjects:

- Scope of electrochemistry and the context of electroanalytical chemistry
- Electrode/solution interfaces and the origin of potentials
- Equilibrium techniques (pH measurement, ion selective electrodes)
- Dynamic electrochemistry, including instrumentation, techniques, mass transport and kinetics
- Cyclic voltammetry and potential step methods
- Hydrodynamic electrodes: rotating disc electrode; jet electrodes; dropping mercury electrode; channel electrodes
- Electrode material considerations and potential windows
- New electrode materials: diamond and carbon nanotubes
- Stripping voltammetry
- Microelectrode techniques
- Electrochemical imaging
- Online-line analysis, lab-on-a chip concept and array techniques

Laboratories:

Cyclic voltammetry; rotating disc electrode or microelectrode; determination of fluoride in toothpaste

Learning outcomes

By the end of the module, students should be able to:

- Show an advanced understanding of the fundamental principles behind modern electroanalytical techniques.
- Discriminate between various electroanalytical techniques, understanding the advantages, disadvantages and current applications of each.
- Demonstrate the ability to evaluate and interpret data from a variety of measurements.
- Display practical consideration for sources and treatment of experimental error.
- Understand the demand for different sensor technologies and the principles and practice of their application.

- Follow good and safe practice in the laboratory.
- Demonstrate sound laboratory and measurement skills.
- Produce clearly written and original scientific reports. Research and reference relevant literature.

Indicative reading list

[Reading lists can be found in Talis](#)

Subject specific skills

- Show an advanced understanding of the fundamental principles behind modern electroanalytical techniques.
 - Discriminate between various electroanalytical techniques, understanding the advantages, disadvantages and current applications of each.
 - Demonstrate the ability to evaluate and interpret data from a variety of measurements.
 - Display practical consideration for sources and treatment of experimental error.
 - Understand the demand for different sensor technologies and the principles and practice of their application.
 - Communicate verbally and in writing
 - Demonstrate numeracy
 - Independently use information technology: data-fitting software and spreadsheets
 - Locate and evaluate relevant information from outside sources
 - Manage time effectively
- Cognitive Skills:
- Critically analyse data
 - Comprehensively assess errors in data
 - Test hypotheses using experimental data
 - Interpret results using information from literature.
 - Follow good and safe practice in the laboratory.
 - Demonstrate sound laboratory and measurement skills.
 - Produce clearly written and original scientific reports. Research and reference relevant literature.

Transferable skills

Scientific/Report writing

Critical Thinking within Data Analysis and Experiment design

Study

Study time

Type	Required
Lectures	8 sessions of 2 hours (16%)
Seminars	2 sessions of 2 hours (4%)
Tutorials	1 session of 1 hour (1%)
Practical classes	4 sessions of 3 hours (12%)
Other activity	8 hours (8%)
Private study	59 hours (59%)
Total	100 hours

Private study description

Self study, preparation and and writeups: 62 hours

Other activity description

Preparation for practical and pre-lab work

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group C4

	Weighting	Study time	Eligible for self-certification
Assessment component			
Lab reports	25%		Yes (extension)
Reassessment component is the same			
Assessment component			
Lab report	25%		Yes (extension)
Reassessment component is the same			

Weighting Study time Eligible for self-certification

Assessment component

Written Examination (Locally Held)	50%	No
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Reassessment component is the same

Feedback on assessment

Written and verbal feedback on pre-laboratory write-ups , verbal feedback during laboratory classes on performance, written feedback on lab report and verbal feedback during problem and revision classes

[Past exam papers for CH914](#)

Availability

Courses

This module is Optional for:

- Year 1 of TCHA-F1PY Postgraduate Taught Analytical Science and Instrumentation