

## **Inorganic Materials Chemistry**

|                |  |
|----------------|--|
| Module Code:   | CFS7016-B                                    |
| Academic Year: | 2018-19                                      |
| Credit Rating: | 20   |
| School:        | School of Chemistry and Biosciences          |
| Subject Area:  | Chemistry and Forensic Science (ceases 2016) |
| FHEQ Level:    | FHEQ Level 7 (Masters)                       |

Pre-requisites:

Co-requisites:

### **Contact Hours**

| <b>Type</b>    | <b>Hours</b> |
|----------------|--------------|
| Lectures       | 30           |
| Tutorials      | 6            |
| Directed Study | 164          |

### **Availability Periods**

| <b>Occurrence</b> | <b>Location/Period</b>                          |
|-------------------|---|
| BDA               | University of Bradford / Semester 1 (Sep - Jan) |

### **Module Aims**

This module aims to:

Develop a systematic knowledge and understanding of inorganic materials.

Enable you to identify origins of different kinds of physical and chemical properties of different kinds of inorganic materials.

Apply characterisation techniques to analyse the morphology, structure, surface and properties of inorganic materials.

Provide you with knowledge to relate the inorganic materials and their technological applications in real life and R&D.

Develop skills to describe and communicate on advanced materials and their properties in scientifically correct and effective way.

## **Outline Syllabus**

Introduction to inorganic materials.

Synthesis of inorganic materials: The formation of bulk material; Chemical deposition.

Electrical properties of solids: Band theory; Defects; Electrical conductivity in ionic solids: Sodium and lithium ion conductors; d-block metal oxides; Applications.

Transparent conducting oxides and their applications in devices: Sn-doped  $\text{In}_2\text{O}_3$  and F-doped  $\text{SnO}_2$ ; Dye sensitized solar cells; Solid state lighting; OLEDs & OLECs.

Superconductivity: Early examples and basic theory; High temperature superconductors; Applications.

Ceramics, silicates, carbides and nitrides: white pigments; high purity silicon for superconductor; boron nitride; silicon nitride & carbide; Perovskites.

Graphene and carbon nanotubes and their applications.

Porous materials and their applications: Zeolites and metal-organic frameworks (MOFs).

Layered materials and their applications: Thin film; Self-assembled monolayers; Liquid crystals.

Characterization techniques for inorganic materials: Electron microscopy (SEM, TEM); Scanning probe microscopy; Solid state NMR, X-ray photoelectron spectroscopy (XPS), UV photoelectron spectroscopy (UPS), Electron energy loss spectroscopy (EELS), BET surface area analysis.

## **Module Learning Outcomes**

*On successful completion of this module, students will be able to...*

- 1 Describe basic principles for synthesis of various types of inorganic materials & their applications.
- 10 Express, present, and discuss different aspects of materials chemistry in front of peers.
- 11 Use specialist software packages to prepare a scientific presentation.
- 12 Work as a team to discuss, decide, and prepare a presentation on a given subject.
- 2 Describe structure & electrical conductivity in sodium & lithium ion conductors & d-block metal oxides.

- 3 Relate transparent conducting oxides & their applications in devices including Sn-doped  $\text{In}_2\text{O}_3$  & F-doped  $\text{SnO}_2$ ; Dye sensitized solar cells; Solid state lighting & OLEDs & OLECs.
- 4 Describe the basic theory of band theory and superconductivity with examples including high temperature superconductors.
- 5 Demonstrate different applications of superconductors
- 6 Describe synthesis, and basic structural, physical and chemical features of different inorganic bulk materials.
- 7 Explain different processes for thin film preparation.
- 8 Apply your knowledge to relate structural and physical properties of advanced materials and relate these to their applications in real-life and R&D.
- 9 Manage learning activities, seek information from literature sources and apply reporting skills; use a range of data sources to solve problems.

### **Learning, Teaching and Assessment Strategy**

The core content will be delivered by lecture to build up the fundamental knowledge on different types of inorganic materials, their preparations, physical & chemical properties, & applications. This will be supported by tutorial sessions where students will be asked to work in small groups to solve problems based on critical thinking. This will help in peer-learning activities. Formative feedback will be given at the end of these activities.

Students will be assigned to different groups to make a presentation to the cohort in a seminar style. Each group will be given different topics related to the content of the module & chosen from contemporary research. Each group will prepare a summary report on the given topic & give a presentation in a 20-min session in front of other students and the instructor. This will be open to other students/lecturers to attend.

Students will be guided throughout the module with directed study to acquire knowledge & understanding of the underlying concepts underlined in the syllabus.

The VLE will be used to disseminate lecture notes, module handbook, links to online resources, & any announcement regarding the module in advance to the students.

A presentation on contemporary research areas in inorganic materials will cover LO's: 08-12.

An exam at the end of the module will cover LO's: 01-08.

### **Mode of Assessment**

| Type      | Method                    | Description                                 | Length  | Weighting | Final Assess' |
|-----------|---------------------------|---|---------|-----------|---------------|
| Summative | Presentation              | Presentation on contemporary research areas |         | 40%       | No            |
| Summative | Examination - closed book | Closed book exam                            | 2 hours | 60%       | Yes           |

### Legacy Code (if applicable)

CT-4020D

### Reading List

To view Reading List, please go to [rebus:list](#).