

SOLID-STATE CHEMISTRY - Chem 4C03

Winter 2009

An introduction to Solid-State Chemistry including aspects of crystal chemistry, crystal symmetry and synthesis/characterization/physical properties of crystalline ionic solids.

Instructors: Jacques Barbier ABB-420 ext. 23477 barbier@mcmaster.ca

Lectures: Tue 9.30 am ABB-431 (to be confirmed)
 Wed 9.30 am ABB-431
 Fri 9.30 am ABB-431

Evaluation: 40% final exam (2 hr)
 25% midterm exam (1 hr)
 25% assignments (3)
 10% presentation (see below)

RESERVE LIST IN THODE LIBRARY

Smart L. & Moore E. *Solid-State Chemistry - An Introduction* (1992, 2005)
West, A. R. *Basic Solid-State Chemistry* (1988, 1999)
Müller R. *Inorganic Structural Chemistry* (1993)

WEBCT SITE

The webct site will be used primarily to provide links to useful web resources and to post course material.

COURSE CONTENT
(with Chapters/ Sections in Reserve Books)

1/ CRYSTAL CHEMISTRY

The Architecture of Non-Molecular Compounds

Coordination Polyhedra, Common Crystal Structures

Crystal Chemical Factors Determining the Stability of Structures

W1999 (1.9 → 1.17) W1999 (2.1 → 2.14) SM2005 (1.2, 1.6) Mu (2, 15, 16)

2/ CRYSTAL SYMMETRY

Unit-Cells, Crystal Lattices, Periodicity

Point Group Symmetry, Space Group Symmetry

Formal Description of Crystal Structures

W1999 (1.1 → 1.8) SM2005 (1.4, 1.5, 2.1 → 2.6) Mu (18)

3/ SYNTHESIS and STRUCTURAL CHARACTERIZATION of IONIC SOLIDS

Synthesis of Microcrystalline Powders and Single Crystals

Diffraction Methods

W1999 (9) SM2005 (3) W1999 (3)

4/ DEFECTS and PROPERTIES of IONIC CRYSTALS

Point Defects, Ionic Conductivity, Solid Electrolytes

Extended Defects, Non-Stoichiometry

SM2005 (5.1 → 5.4, 5.7 → 5.10) W1999 (5.1 → 5.4, 7.5)

5/ METALS and SEMICONDUCTORS

Free Electron Model, Tight-Binding Model, Band Theory

Electronic Properties, Magnetism, Applications

SM2005 (4, 9.1 → 9.7) W1999 (2.15, 8.1)

Key: Mu (Müller), SM (Smart & Moore), W (West)

STUDENT PRESENTATIONS

Many examples of research topics in solid-state chemistry are available from the current research literature, in particular in *The Journal of Solid-State Chemistry* (link provided on the WebCT site).

Each student will prepare a 15-20 mn PowerPoint presentation in which one recent research article will be summarized by emphasizing the background interest in the solid-state compound(s), the methods of synthesis and characterization, the crystal structure and the properties, as applicable. The presentations will be evaluated for both form and content.
