UCLouvain

lchm2231

2019

Chemistry and functionality of inorganic materials

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

6 credits	45.0 h + 15.0 h	Q2

Teacher(s)	Garcia Yann ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	The teaching will cover the following topics: - defects in inorganic solids and their formation mechanisms. - description of the chemical bond in inorganic solids (band theory) - description of electrical properties (conductors, semi-conductors, superconductors), magnetic, optical and photo-physical properties of principal inorganic solids, and the current applications in the growing domain of functional materials.
Aims	1 This course is directed to students having a basic formation in inorganic chemistry and aiming to complete their formation by advanced notions in physical chemistry of functional inorganic materials. It aims at giving a fundamental understanding of chemical bonding in solids and at illustrating the various applications that result. The functionality associated to molecular electronics is also covered based on an orbital and structural approach. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** oral exam
Content	I. Ponit defects and non-stoichiometry: defect types, origin of intrinsic crystalline defects, point defects (Kröger-Vink notation), non-stoichiomety, extended defects. II. Electronic structure and electrical properties of solids: bonding in solids (band theory), relation between band structure and electronic properties, semi-conductors, electrical properties of some inorganic solids (MO monoxides of the 3d series, transition metal sulfides MS2), ionic and molecular conductors. III. Magnetic properties of materials: recall of basic concepts, magnetism associated to conduction electrons, collective magnetism associated to ions. IV. Analysis methods of magnetism: susceptometers based on a force or induction measurement. Electronic paramagnetic resonance (EPR). Muon spin relaxation spectroscopy (mSR). Neutron diffraction (structural aspects, spin density map). X-ray magnetic circular dichroïsm (XMCD). V.Various magnetic materials and applications: ferrites, garnets, hard and soft magnets, molecular magnets, molecular bistable systems, photo-switches and hybrid materials. VI. Superconduting materials: metallic conductivity and superconductivity, review of superconductivity, BCS theory, superconducting oxides with a high critical temperature, applications of superconductors. VII. Optical and dielectric properties of solids: inorganic lasers, cooperative dielectric properties (ferroelectricity, piezoelectricity).
Inline resources	Moodle
Bibliography	- Introduction à la chimie du solide, L. Smart and E. Moore (trad. J.-P. Jolivet), Masson, 1997. - Solid State Chemistry and its Applications, A.R. West, Wiley, 1984. - Molecular Magnetism, O. Kahn, Wiley, 1993. - Fascicule reprenant la copie des transparents utilisés par l'enseignant. - Fascicle containing a copy of overhead transparencies used by the teacher.
Other infos	Background: Inorganic chemistry I and II (CHM 1331 and CHM 2130). Basic notions in crystallography (CHM 1251A). The course could be partly or totally delivered by an invited lecturer.
Faculty or entity in charge	CHIM

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Chemistry	CHIM2M	6		