UCL Université catholique de Louvain

# LCHM2231

*2015-2016*

# Chemistry and functionality of inorganic materials

| 6.0 credits | 45.0 h + 15.0 h | 2q |
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| Teacher(s) : | Garcia Yann ; Devillers Michel ; Garcia Yann (compensates Devillers Michel) ; |
| Language : | Anglais |
| Place of the course | Louvain-la-Neuve |
| Main themes : | The teaching will cover the following topics:<br>- defects in inorganic solids and their formation mechanisms.<br>- description of the chemical bond in inorganic solids (band theory)<br>- 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 : | 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.<br>*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".* |
| Content : | I. Ponit defects and non-stoichiometry: defect types, origin of intrinsic crystalline defects, point defects (Kröger-Vink notation), non-stoichiomety, extended defects.<br>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.<br>III. Magnetic properties of materials: recall of basic concepts, magnetism associated to conduction electrons, collective magnetism associated to ions.<br>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).<br>V.Various magnetic materials and applications: ferrites, garnets, hard and soft magnets, molecular magnets, molecular bistable systems, photo-switches and hybrid materials.<br>VI. Superconduting materials: metallic conductivity and superconductivity, review of superconductivity, BCS theory, superconducting oxides with a high critical temperature, applications of superconductors.<br>VII. Optical and dielectric properties of solids: inorganic lasers, cooperative dielectric properties (ferroelectricity, piezoelectricity). |
| Other infos : | Background: Inorganic chemistry I and II (CHM 1331 and CHM 2130). Basic notions in crystallography (CHM 1251A).<br>Evaluation: oral exam<br>Documents:<br>- Introduction à la chimie du solide, L. Smart and E. Moore (trad. J.-P. Jolivet), Masson, 1997. ISBN 2225856214<br>- Solid State Chemistry and its Applications, A.R. West, Wiley, 1984. ISBN 0471908746<br>- Molecular Magnetism, O. Kahn, Wiley, 1993. ISBN 0471188387<br>- Fascicle containing a copy of overhead transparencies used by the teacher.<br><br>The course could be partly or totally delivered by an invited lecturer. |
| Faculty or entity in charge: | CHIM |

| Programmes / formations proposant cette unité d'enseignement (UE) | | | | |
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| Intitulé du programme | Sigle | Credits | Prerequis | Acquis d'apprentissage |
| Master [120] in Chemistry | CHIM2M | 6 | - | |