MSE-231 **Ceramics, structures and properties + TP**

Damjanovic Dragan

Cursus	Sem.	Type
Materials Science and Engineering	BA6	Obl.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	3 weekly
TP	1 weekly
Number of positions	

Summary

Students analyze crystal structures, point defects and phase relations in ceramic materials and understand their effect on electrical, thermal and electromechanical properties. Properties of ceramic materials are investigated experimentally and results analyzed and interpreted.

Content

1. Crystalline structure of the most important ceramics.
2. Point defects and their relationship to functional properties.
3. Mechanical and thermal properties of ceramics
4. Electronic and ionic conductivity in ceramics, dielectric, piezoelectric, and ferroelectric materials and their applications
5. Experimental characterisation of properties of ceramics and practice with instruments for measurements of electrical and electro-mechanical properties.
6. Analysis and interpretation of experimental results
7. Making use of suitable instruments for electromechanic measurements

Keywords

ceramics; crystal structure; point defects; phase equilibria; conductivity; semiconductor; dielectric; piezoelectric; ferroelectric; electro-mechanical; electrical charaterization;

Learning Prerequisites

Required courses

General physics;
General inorganic chemistry;
Mathematical analysis;
Introduction to materials;

Recommended courses

Crystallography and diffraction methods;
Theory of materials I: from structure to properties
Thermodynamics for materials science

Important concepts to start the course

chemical bonds; phase transitions; atomic and electronic structure of materials; thermodynamics; microstructure of materials; symmetry and materials;

Learning Outcomes

By the end of the course, the student must be able to:

- Apply The acquired notions of the dispersion of particulate matter for any application.
- Produce Acquired the knowledge, skills and practice necessary to produce a ceramic in an industrial environment or a laboratory
- Choose to produce a ceramic of a particular geometry in connection with an application.
- Demonstrate the colloidal stability of a suspension using the DLVO theory.
- Describe the key characteristics of a ceramic powder needed to make a ceramic

Transversal skills

- Collect data.
- Use both general and domain specific IT resources and tools
- Write a scientific or technical report.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Take responsibility for health and safety of self and others in a working context.
- Use a work methodology appropriate to the task.
- Set objectives and design an action plan to reach those objectives.

Teaching methods

Lectures and exercises in class (3 h) and laboratory work (1 h)

Expected student activities

Attendance of lectures, doing exercises during class and at home, reading written material, discussion in class, doing experimental exercises, writing reports on experimental work and analyzing results

Assessment methods

The final grade is attributed based on the grade of the final written exam (75%) and the average grade of the TP reports (25%).

Supervision

Office hours	Yes
Assistants	No
Forum	No

Resources

Bibliography

Chiang, Birnie, Kingery: Physical Ceramics; Wiley, NY.
Moulson and Herbert: Electroceramics
Newnham: Properties of Materials: Anisotropy, Symmetry, Structure; Oxford University, Oxford.

Ressources en bibliothèque

- Electroceramics / Moulson
- Properties of Materials: Anisotropy, Symmetry, Structure / Newnham
- Physical Ceramics / Chiang

Notes/Handbook

Copy of slides presented during lectures; Wriiten text based on lectures; Text for each TP;