Dielectric properties of materials

Summary
Students learn about response of electrically insulating materials to electrical and mechanical fields. The emphasis is on effect of various types of defects on properties, on crystal structure/microstructure - property relations, and on ways how to engineer properties of materials for applications.

Content

Keywords
dielectrics; ceramics; single crystals; electrical conductivity; dielectric relaxation; piezoelectricity; ferroelectricity, capacitors; thermistors; actuators; sensors; resonators; composites; multiferroics;

Learning Prerequisites
Required courses
General physics;
General inorganic chemistry;
Mathematical analysis;
Introduction to materials;
Thermodynamics;

Recommended courses
Christallography and diffraction methods;
Theory of materials: from structure to properties I

Important concepts to start the course
atomic and electronic structure of materials; chemical bonds; phase transitions; symmetry and materials;

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

- Interpret given experimental behavior of materials in terms of physical processes learned during the course
- Hypothesize how crystal structure, defects structure, microstructure, chemical composition affect properties of materials.
- Argue on advantages and disadvantages of given materials for various applications

Transversal skills

- Take feedback (critique) and respond in an appropriate manner.
- Access and evaluate appropriate sources of information.
- Continue to work through difficulties or initial failure to find optimal solutions.

Teaching methods

lectures; discussions;

Expected student activities

attendance of lectures; reading distributed written material; participating in discussions in class;

Assessment methods

Written exam

Supervision

Office hours Yes
Assistants No

Resources

Bibliography
Moulson, "Electroceramics", Chapman&Hall 1990

Ressources en bibliothèque
- Properties of materials : anisotropy, symmetry, structure / Newnham
- Electroceramics / Moulson

Notes/Handbook
Copies of viewgraphs; Written text based on lectures (partial coverage);