EPFL

CH-450 | **Solid state chemistry and energy applications**

Queen Wendy Lee

Cursus	Sem.	Type
Chimiste	MA2, MA4	Opt.
Ing.-chim.	MA2, MA4	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Oral
Workload	90h
Weeks	14
Hours	**2 weekly**
Courses	2 weekly
Number of positions	

Summary

You will learn about the bonding and structure of several important families of solid state materials. You will gain insight into common synthetic and characterization methods and learn about the applicability of several classes of materials in energy relevant applications.

Content

The course is split into 3 modules:
1) Fundamentals of solid-state chemistry: classifications of solid materials and how their bonding influences properties, synthetic methods, crystal systems and lattices, close-packed strucutres.
2) Characterization of solid materials: Various forms of characterization of solid materials will be discussed. For isntance, from neturon/X-ray diffraction you should be able to answer what information can we obtain and and how to select the probe. The course might also briefly discuss other forms of characterization such as thermal and elemental analysis, adsorption measurements, and various forms of spectroscopy.
3) Recent advances in the development of solid materials and applications: The students will be introduced to different types of solid-state materials, such as activated carbons, zeolites, and metal-organic frameworks and their applications particularly those related to energy, i.e hydrogen storage and gas separations. Some other examples of energy applications that the students will be introduced to include include batteries, catalysis, photovolataics, and/or fuel cells.

Learning Prerequisites

Important concepts to start the course

Learning Outcomes

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

- Classify solid state materials
- Demonstrate knowledge of the structures and properties of solid materials
- Assess / Evaluate the importance of solid materials in various energy applications
- Demonstrate knowledge of chracterization methods
- Construct presentation on an unfamiliar topic.
- Assess / Evaluate the literature

Transversal skills

- Make an oral presentation.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Set objectives and design an action plan to reach those objectives.
- Communicate effectively, being understood, including across different languages and cultures.
- Demonstrate the capacity for critical thinking
- Access and evaluate appropriate sources of information.

Teaching methods

Expected student activities

The students are expected to attend all lectures and exercise sessions.
There is typically one exercise session dedicated to understanding solid state structures and close-packed systems using molecular modeling kits. Should courses be online, we are unsure if we will be able to do this modeling portion of the class.
The students are also expected to participate in a group project during the 3rd module. Each group will carry out a short literature survey on an assigned topic that includes a class of solid materials and an energy-related application. A group presentation will be given to describe their findings in the last few weeks of the course. The group presentation is meant to reinforce the topics learned earlier in the course.

Assessment methods

There will be a group presentation that is worth 30% of the final grade and an oral exam that is worth 70% of the final grade.

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

Basic Solid State Chemistry, Second Edition, Anthony R. West (John Wiley & Sons, 1999)
Reactions and Characterization of Solids, Sandra E. Dann (John Wiley & Sons, 2002)

Ressources en bibliothèque

- Basic solid state chemistry / West
- Reactions and characterization of solids / Dann

Moodle Link

- https://go.epfl.ch/CH-450