CH-450  
**Solid state chemistry and energy applications**  
Queen Wendy Lee

<table>
<thead>
<tr>
<th>Cursus</th>
<th>Sem.</th>
<th>Type</th>
<th>Language</th>
<th>Credits</th>
<th>Session</th>
<th>Semester</th>
<th>Exam</th>
<th>Workload</th>
<th>Weeks</th>
<th>Hours</th>
<th>Lecture</th>
<th>Number of positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chimiste</td>
<td>MA1, MA3</td>
<td>Opt.</td>
<td>English</td>
<td>3</td>
<td>Winter</td>
<td>Fall</td>
<td>Oral</td>
<td>90h</td>
<td>14</td>
<td>2 weekly</td>
<td>2 weekly</td>
<td></td>
</tr>
</tbody>
</table>

**Summary**

Students will learn about the structure & properties of several classes of solid state materials and gain insight into their importance in energy relevant applications.

**Content**

The course is split into 3 modules:

1) **Fundamentals of solid-state chemistry**: classificatons of solid materials and how their bonding influences properties, synthetic methods, crystal systems and lattices, close-packed structures.

2) **Characterization of solid materials**: Various forms of characterization of solid materials will be discussed. For instance, from netunon/X-ray diffraction you should be able to answer what information can we obtain 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, photovoltaics, and/or fuel cells.

**Learning Outcomes**

- 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 characterization methods
- Construct a 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.

**Expected student activities**
The students are expected to attend all lectures and exercise sessions. There is one exercise session dedicated to understanding solid state structures and close-packed systems using molecular modeling kits. 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 25% of the final grade and an oral exam that is worth 75% of the final grade.

Resources

Bibliography

Moodle Link