EPFL

CH-406   **Analysis of ancient materials and their degradation**

Gervais Claire

Cursus	Sem.	Type
Chimiste	MA1, MA3	Opt.
UNIL - Sciences forensiques	H	Opt.

Language of teaching	English
Credits	2
Session	Winter
Semester	Fall
Exam	Oral
Workload	60h
Weeks	14
Hours	**2 weekly**
Courses	2 weekly
Number of positions	

Remark

According to the number of students (and interest), possibility to participate to the preparation and post-evaluation of a synchotron experiment (XAS scheduled in October or November).

Summary

This course aims at introducing ancient materials and their investigation by non-destructive synchrotron and imaging techniques. Case-studies on paintings, ceramics, stained glass, fossils will be presented and important concepts introduced and discussed (multiscale, heterogeneity, representativity)

Content

1. What are ancient materials?
2. Challenges in analyzing heterogeneous and sensitive materials
3. Synchrotron techniques for ancient materials (X-ray absorption spectroscopy, X-ray fluorescence, photoluminescence)
4. X-ray tomography techniques: Going to 3D and 4D imaging
5. Physico-chemistry of materials degradation
6. Case-studies of ancient materials and their degradation

Examples of case-studies:
– Cobalt blue degradation in oil paintings.
– Identification of archaeological ivory and its degradation.
– Nanoinvestigation of 19th century daguerreotype photographs.
– Initial corrosion processes in reinforced concrete monuments.
– Fossilization and diagenesis processes.

Keywords

Cultural heritage; synchrotron techniques, degradation processes, X-ray absorption spectroscopy, tomography, 2D imaging

Learning Prerequisites

Required courses

Basics in solid-state, inorganic and organic chemistry, notions in spectroscopy and materials sciences. An introductory lecture will be given if necessary.

Learning Outcomes

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

• Assess / Evaluate the danger of beam damage for a given object

- Describe the main constituents of a variety of ancient materials (paintings, ceramics, photographs, wall painting, etc)
- Choose appropriate technique(s) and measurement scale
- Propose an analytical framework to optimize information obtained from a micro-sample
- Describe X-ray absorption spectroscopy
- Interpret XANES and XAFS spectra
- Describe the principles of absorption tomography
- Construct chemical imaging data

Transversal skills

- Use a work methodology appropriate to the task.
- Demonstrate the capacity for critical thinking
- Plan and carry out activities in a way which makes optimal use of available time and other resources.

Teaching methods

Ex cathedra, presentations by students and paper discussions

Expected student activities

The students are expected to read chosen literature beforehand and to prepare a short summary that will serve as a basis for the lecture and discussion.

Assessment methods

Oral exam, with formal short presentation + questions.

Supervision

Forum   Yes