Seminars on analytical techniques for materials sciences – part II, optical, electrical, and mechanical characterizations as well as theoretical modelling

Level
Doctoral studies (also open to senior scientists, etc. depending on availability)

Course aim
Although many of us are familiar with many analytical techniques, such as photoluminescence, Raman, and infrared absorption spectroscopy, electrical measurement, scanning probe microscopy etc., but not all of us are aware of their full potential. To deepen our research, it is necessary to combine experiment results with theoretical modelling and calculations. Many techniques are used as a routine but the user might not always know the true advantage or the drawbacks. We have many techniques built at IFM, but we may not know what to study and how to access. We also need to increase the awareness on sample requirements or providing proper information prior the use of the technique in mind. This is something that is fundamental but very often underrated. There are lots of examples where a good work could have been even better with a correct sample preparation or information input.

The purpose of this seminar-based course is to provide a brief introduction focusing on different materials characterization techniques and especially which information that can be extracted in order to increase efficiency in gathering more and better useful information about our materials and to understand how to combine different techniques for complementary information.

A series of technique presentations will give a better insight in how to make the best choice of technique to your studied materials, what kind of information that can be extracted from the measurements, why this technique is a good choice, when another techniques should be considered, and how/where to access these instruments.

Prerequisites
No prerequisites.

Organization and course content
The seminars consist of presentations given by experts who have been worked these techniques for many years and are in charge of the instruments. The series of presentations given by experts is scheduled as the followings.

2017. 12. 01/1a. Spectroscopic Ellipsometry – Roger Magnusson
1b. Thz spectroscopy – Philipp Kühne

2017.12. 08/2a. Photoluminescence spectroscopy (PL)/ PL excitation – Fredrik Karlsson
2b. Time-resolved optical spectroscopy – Galia Pozina

2017. 12. 15/3a. Scanning tunnelling microscopy – Weimin Wang
3b. Angle-resolved photoemission spectroscopy - Roger Uhrberg
The outline of presentations includes:

- Fundamentals, advantage, and drawbacks of the technique/the outcomes of the measurement.
- Sample requirements, including sample handling, information input, sample mounting, sensitivity for contamination, etc.
- Representative examples.
- Practical issues/most common errors.
- Access to the technique.
- Advantage of different systems/same technique.
- Information about relevant courses.

**Literature**
Lecture notes will be sent by email before the seminar.

**Examination for seminars**
Part I: 80% correct answers on each test (quiz) after seminar. Student who failed a test have to write a report of the seminar instead. (One A4 page)

Part II: attendance, at least 8 seminars.
Laboration

After the seminars, students have a chance to measure own samples or build a model for their studies. Registered students, who pass the seminar lectures, can choose two techniques, which will be offered by some of our experts. After the experiments, student needs to write a report to finish the laboration.

Student credits

1. Seminars: 3 hp
2. Laboration: 1 hp

Registration

Please, register to Ching-Lien Hsiao by email (hcl@ifm.liu.se) no later than Nov. 15. Please, include full name, division, and preferred email address to be used for correspondence during the course.

Course plan

1. Seminars
   - December, 2017 – February, 2018
   - 13:15-15:00, Every Friday
   - Final seminar schedule will be announced one week before the course starts.
   - Length of each presentation: 50 min, including questions. Two presentations/seminar.

2. Laborations
   - March-April, 2018
   - Choose two different techniques
   - Each technique can have maximum 3 students
   - Studied materials need to be discussed with experts before choosing the technique

Most welcome!

Ching-Lien Hsiao and the Thin Film Physics Division, IFM