



## MENA 9510 - Advanced characterization methods

### Course content

The course on advanced characterization methods is organized within the Research School at the Norwegian Research Centre for Solar Cell Technology (FME-SOL). It will include the techniques relevant for characterization of materials and components for solar cells. The course emphasis is on hands-on exercises. An introduction to each technique will be supervised by an expert in this technique. The course is divided in 4 modules: (i) *Structure and composition of solar-grade materials*, (ii) *Optical characterization of semiconductors for solar cells*, (iii) *Electrical characterization of solar cell materials*, and (iv) *Characterization of silicon wafers and solar cells*.

When: October 10<sup>th</sup> -14<sup>th</sup> and October 31<sup>st</sup>- November 4<sup>th</sup> 2011 (weeks 41 and 44)

Where: University of Oslo

Target group: PhD students, posdocs, researchers from industry and institutes

Credits: 5

### Registration

UiO students should sign up through StudentWeb as soon as possible. External PhD students need to apply for status as visiting student. The deadline was actually August 12, but please contact [vebjorn.bakken@kjemi.uio.no](mailto:vebjorn.bakken@kjemi.uio.no) immediately if you want the course as part of your PhD curriculum. Postdocs that just want to follow the course should send an email to [vebjorn.bakken@kjemi.uio.no](mailto:vebjorn.bakken@kjemi.uio.no) no later September 17<sup>th</sup>.

### Description of modules:

1. *Structure and composition of solar-grade materials*  
Within this module the participants will be introduced to techniques for the analysis of structure, chemical composition and trace impurities in materials relevant for solar cells: X-ray photoelectron spectroscopy (XPS) and secondary ion mass spectrometry (SIMS).
2. *Optical characterization of semiconductors for solar cells*  
Optical characterization will be performed by photoluminescence (PL) and Fourier transform infrared absorption (FTIR).
3. *Electrical characterization of solar cell materials*  
Electrical characterization techniques will include capacitance-voltage characteristics (CV) and deep level transient spectroscopy (DLTS).
4. *Characterization of silicon wafers and solar cells*  
In this module, carrier life-time and quantum efficiency measurements will be performed.

### Learning outcomes

The students are expected to understand fundamental principles of the techniques presented in the course, their advantages and limitations. Furthermore, the student should understand the requirements for samples suitable for each technique. They should also be able to perform simple characterization measurements with no or little assistance from the experts.

### Exam

One month after the teaching is finished a project report should be handed in.

### Recommended literature

Dieter K. Schroder: *Semiconductor Material and Device Characterization*