

科目名 ナノテクノロジー特別講義V (1単位)

担当教員 都倉康弘 教授

科目番号 ※専攻によって異なります。

Advanced materials characterisation using X-ray and neutron scattering:

By Mogens Christensen (Aarhus University)

Course description:

Advances in material science come through an in-depth understanding of the relationships between structure and properties. Profound insights into these relationships are a common goal across condensed matter science, from high precision crystallographic studies to kinetics studies. Structural understanding is a prerequisite for the rational design of new and improved materials.

In this course X-ray and neutron scattering techniques for materials science characterization will be taught through recent examples related to thermoelectric materials and permanent magnets. It will be demonstrated how size and size distribution can be extracted from X-ray powder diffraction data. Information about crystallization and crystal growth can be obtained by performing in situ X-ray powder diffraction and total scattering investigations. Texture analysis from X-ray diffraction data can provide information about the orientation of the crystallites in the investigated sample. The use of neutron powder diffraction to extract the magnetic structure at the atomic scale is demonstrated during the lectures. Finally, the course will be concluded with measurements of phonons using inelastic neutron scattering.

Outline:

- 1) Introduction of neutron and X-ray scattering techniques.
- 2) Size and size distribution from nanocrystallites using X-ray powder diffraction.
- 3) In situ characterization of crystallization and growth.
- 4) Texture information from oriented nanocrystals.
- 5) Magnetic structure at the atomic scale obtained from neutron powder diffraction.
- 6) Phonon investigations using inelastic neutron scattering.

Textbook:

No textbook is required – lecture notes and original paper from the literature will be posted on the course web page.

Prerequisite:

Knowledge of quantum mechanics and condensed matter science is advantageous.