

NÉEL INSTITUTE Grenoble

Topic for Master 2 internship – Academic year 2019-2020

Extreme Microscopy for Elusive Nano-Materials

General Scope:

Nowadays new materials are invented in order to address social and economic issues. Chemists at the Néel Institute synthesize new materials every day in search of new electrochemical, multiferroic or optical properties!

Understanding the physical properties of a material (superconductivity, magnetism, non-linear optics ...) implies to completely know its internal organization. However, since most of these syntheses are done in extreme conditions, *ie.* at high temperature and high pressure, these materials are in the form of powders which in general contain several phases. In this case, conventional techniques of crystallography, including the X-ray diffraction, reach their limits of applicability!

Transmission electron microscopy is a powerful technique that is particularly well suited for research on nanomaterials, since it allows studying solids at atomic length scales. The recently developed crystallographic methods for the study of nanomaterials based on electron diffraction are particularly efficient. In particular, using electron diffraction tomography (EDT) we can determine the crystallographic structure of an unknown phase from a single nano-metric particle.

Thus, this method is ideally suited to solve newly synthesized unknown structures!

Research topic and available facilities:

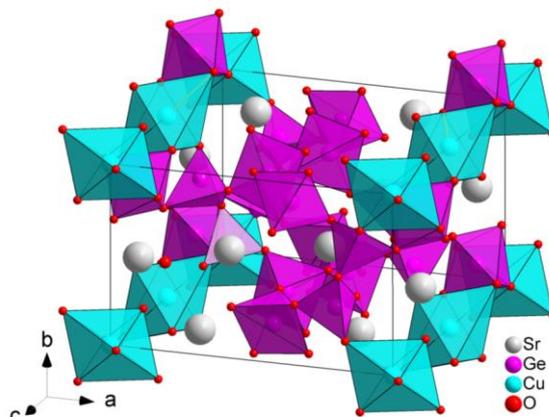
The goal of this internship is to determine the structures of unknown phases using electron diffraction tomography. The internship will include several stages:

- Performing electron diffraction tomography experiments
- Determining the structures of unknown phases using specialized crystallographic software.
- Investigating the influence of different experimental parameters on the quality of the structure solution.

The intern will be trained in the use of the transmission electron microscope of the Néel Institute. He/she will acquire diffraction data and perform the complete data treatment using specific computer programs that are available at the Néel Institute, which should lead to the resolution of the structures.

Possible collaborations and networking:

The intern will be integrated into the electron microscopy group of the Néel Institute. He/she will collaborate with the chemists that synthesize the materials and the physicists of the Néel Institute interested in the physical properties.



Possible extension as a PhD: Yes.

Education / Required skills: Master in Physics, Solid state chemistry, instrumental physics. Basic knowledge in crystallography and diffraction

Start date: 2020

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