

PhD position opening (2022-2025)

Optimization of thermoelectric and optoelectronic properties of 2D chalcogenide materials by texturing

Scientific context:

Solid chalcogenide-based compounds crystallizing in a 2D layered type structure such as BiOCuX (X = S, Se and Te) or sulfur misfit compounds such as (LaS)_{1.14}(TS₂) (T = Cr, Nb, ...) show a wide range of properties and functionalities (thermoelectricity, optoelectronics, superconductivity...). These properties can be modulated by doping, but it is also possible to take advantage of their anisotropies to optimize their physical characteristics by improving the mobility of the charge carriers in the plane of the conductive layers by adjusting their texturing. Here, the recruited PhD student will use innovative techniques for texturing materials, including the slip casting texturing process of a suspension under a magnetic field. The application of a magnetic field during casting makes it possible to force the orientation of the particles in suspension along their axis of easy magnetization and therefore to provide control over the final texture of the material. The preparation of stable suspensions whose individual particles couple optimally with the magnetic field, is a key aspect for the successful use of this technique. The doctoral student recruited and assigned at IMN will have access to all the techniques necessary to synthesize chalcogenide materials in 2D layers (sulfur bench, mechano-synthesis, solvothermal synthesis, sealed tube, etc.) in the form of particles of the appropriate size to obtain a sufficiently stable dispersion, necessary for the process of alignment under field.

Work context:

The PhD grant is an INTERNATIONAL THESIS funded by CNRS in the framework of a collaboration between IMN (Institut des Matériaux de Nantes Jean Rouxel), Nantes, France (<https://www.cnrs-imn.fr/>) and the International Research Laboratory LINK (Laboratory for Innovative Key Materials and Structure) located at the National Institute for Materials Science, Tsukuba, Japan (<https://link.cnrs.fr/>). Within this international project, the student will be trained at IMN under the supervision of Stephane Jobic and Laurent Cario on the synthesis and characterization of layered chalcogenides. Mobility (6-12 months) between France and Japan is expected for the completion of this project. At LINK, the student will be supervised by David Berthebaud and will work in close collaboration with Pr. Tohru Suzuki to be trained on texturation process under magnetic field. He/She will also have access to state-of-the-art facility at NIMS (Pr. Takao Mori group) to characterize his/her materials properties (thermoelectric, optoelectronics ...).

Profile:

The candidate will have a strong scientific curiosity and the will to develop a strong expertise in the fields of solid-state chemistry. With a M2 and/or engineering school degree in materials science, he/she should have a solid and varied background in both synthesis (solid state reactions, soft chemistry) and characterization (X-ray diffraction, thermoelectric measurements, magnetism, optical properties) of materials. A good level of English is required. The candidate should send a detailed CV to Stephane Jobic (stephane.jobic@cnrs-imn.fr), Laurent Cario (laurent.cario@cnrs-imn.fr), and David Berthebaud (david.berthebaud@cnrs.fr)