Post-doc on the investigation by transmission electron microscopy of point defects and stacking faults in BN nanostructures

Project description: More and more technologies, implemented in nowadays devices or foreseen in next-generation ones, are or will be based on the intriguing properties of the quantum world. Applications include single-molecule and precise field sensing, quantum computing, single-particle emission/detection, twistronics and so on. They require the design and manipulation of materials at the nanometric scale, where the quantum nature of matter manifests itself (quantum materials). In this respect, nanoobjects and local singularities (e.g. point defects in crystals, exotic local spin textures, moiré patterns) are ideal supports for quantum-based technologies. The challenge is that of understanding and controlling at the atomic scale the very relation between their structure and the aimed properties.

The goal of this postdoctoral project is to carry out state-of-the-art experimental research on stacking and point defects of hexagonal boron nitride with the intent of elucidating the link between structure and properties. The systems of choice will include twisted interfaces, chemical defects and lattice reorganizations which may be natively present or generated on purpose. The project will stem from the recognized expertise of the laboratory on BN systems and will exploit the full potential of the recently acquired MOSTRA microscope. The machine, a JEOL probe-corrected NEOARM equipped with a cold FEG, capable of operating at 30, 60, 80 and 200 kV in all of its acquisition modes, brings together a unique set of functionalities and implements state-of-the-art techniques such as 4D-STEM and DPC. Furthermore, a customized CEOS Energy filter enables the acquisition of Angle-Resolved Electron Energy Loss (AR-EELS) maps, particularly relevant for the investigation of the dielectric function in anisotropic or angle-dependant systems (e.g. moiré physics).

In addition, the researcher will take advantage of other assets of the Laboratoire d'Etude des Microstructures (LEM) (https://lem.onera.cnrs.fr/en/home/). Direct access to dedicated synthesis and fabrication facilities (CVD, glove box) and to LEM's dense network of collaborations (legacy of the Graphene Flagship, GDR HOWDI) will be crucial to provide samples for the study. Further development will be granted by the dialog with advanced atomistic simulations (ab initio and tight-binding) carried out in the laboratory and the lively context offered by ONERA, including access to other characterization methods (Raman, photoluminescence) and the connection with the Qtech laboratory which is devoted to applied studies on quantum materials.

Job description: 12 months from June 2025 at LEM, Châtillon (France). May be extendable.
Academic Level: Ph. D in Physics, Materials Science, Nanomaterials
Activities: Identification of the structural properties of point defects (nature, density) and stacking defects (number of layers, twist angle, stresses) using different imaging modes and TEM analysis, implementation of advanced techniques such as 4D-STEM and DPC (Differential Phase Contrast), acquisition of angle-resolved electronic energy loss maps (AR-EELS), CVD (Chemical Vapor Deposition) synthesis of hBN, glovebox fabrication of BN bilayers.
Expertise: strong skills in TEM (different modes: imaging, 4D-STEM, EELS, etc.), ability to set up original instrumental developments, experience in investigating low-dimensional structures (2D, 1D, 0D, etc.) or quantum materials. Previous experience in the synthesis/fabrication of nanomaterials would be a real plus
Location: LEM, Châtillon, France
Salary: 3000 – 3500 euros / month
Application: send your CV with publication list, a motivation letter and provide at least two references to annick.loiseau@onera.fr and hakim.amara@onera.fr