PhD position: Strain field imaging in semiconductors: from materials to devices

The Subject. Controlling deformation is fundamental to optimize the electronic transport, mechanical and thermal properties of semiconductor materials. This work will address the visualization and quantification of their deformation fields, using synchrotron radiation techniques.
In a dual technique approach, we will combine the determination of the local deviatoric strain tensor by scanning the sample under i) a polychromatic nano beam (µLaue) and ii) a monochromatic full field imaging with a larger beam (dark field x ray microscopy, DFXM).
New developments of the analysis will be focused on 1/ the improvement of the accuracy and speed of the quantitative strain field determination, 2/ the analysis of strain gradient distributions in the materials, and 3/ the determination of the dynamic strain field in piezoelectric materials through stroboscopic measurements. To explore these points, three scientific cases corresponding to relevant microelectronic materials of increasing complexity will be studied:
1-Static strain fields surrounding metallic contacts, such as high-density through silicon vias (TSV) in CMOS technology.
2-Strain gradients in Ge/GeSn complex heteroepitaxial structures with compositional variations along the growth direction.
3-Dynamical strain in $LiNbO_3$ surface acoustic wave resonators with resonance frequency in the MHz range.
Establishing this approach will mean moving a step forward towards more efficient microelectronics and strain engineering.

The Function. The project will be nested at the NRX team (MEM laboratory) within CEA-IRIG and with access to the F-CRG IF-BM32 beamline hosted by The European Synchrotron (ESRF), a world-leading X-ray facility located in Grenoble, France. The candidate will first receive training on the synchrotron radiation techniques & corresponding data analysis, and perform predictive simulations to access the strain gradient variations. Then a novel stroboscopic setup will be developed to perform one of a kind operando experiment unlocking access to the time dependent strain evolution within devices.

Profile Of the Applicant. The candidate should have:
- A master degree in physics, materials science or nanotechnology, preferably with a background on solid-state physics or crystallography.
- Experience in simulations or Python.
- A strong interest in structural characterization.
- Initiative, a high degree of responsibility, fast learning capabilities and a drive to problem solving.
- Good management and presentation skills as well as excellent written and oral English level (among nonnative English speakers).

Contract Characteristics. This is a 3-year contract located at Grenoble and granted by CEA, starting November 2025. Interested applicants should submit: (1) 1 page cover letter stating the motivation, research experience and goals; (2) curriculum vitae, and (3) contact information for 2 references to Raquel Rodriguez Lamas (raquel.rodriguezlamas@cea.fr) and Joel Eymery (Joel.eymery@cea.fr). Deadline: 30 Avril 2025.