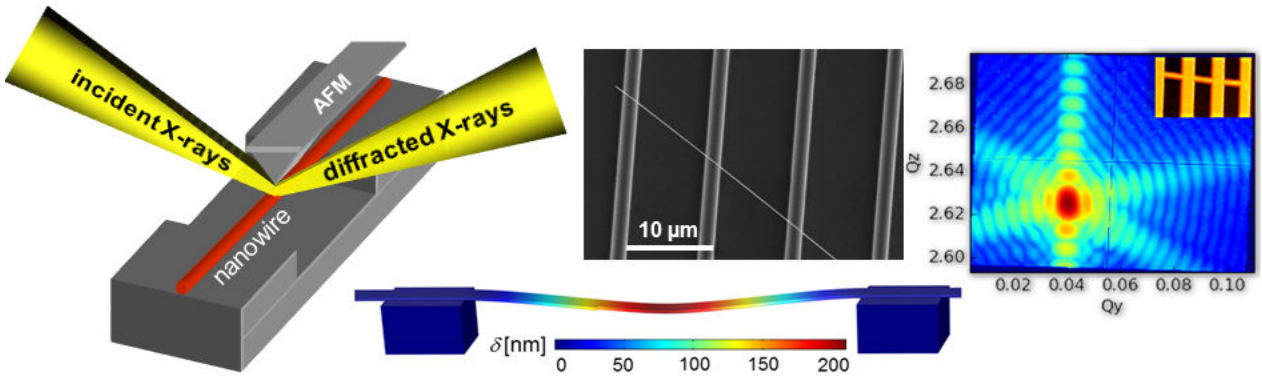
PhD thesis on

In situ nano-mechanical studies on metal and semiconductor nanostructures

The CMO group of IM2NP (www.im2np.fr) at Aix-Marseille university offers a PhD thesis focusing on the mechanical properties of BCC metal (Fe) and semiconductor (GaN, ZnO) nanostructures such as nanowires and nano-particles. Thanks to their extraordinary characteristics, these nanomaterials are potential candidates for various types of applications in optoelectronics, as sensors, or in nano-electromechanical systems (NEMS). The extraordinary behaviors originate from size effects which occur when the size of these objects become comparable to intrinsic length scales such as the diffusion length of defects. For instance, they may show ultra-high mechanical strengths reaching the ultimate limit of the material. While the mechanical behavior of FCC nanostructures is rather well studied, the elastic and plastic behavior of BCC metals and, in particular, Fe nanostructures is still under debate. The elevated yield strength found for low-dimensional materials and the fact that elastic strain significantly modifies the electronic structure of semiconducting micro- and nanostructures allows for improving the performance of such low-dimensional materials by elastic strain engineering. To understand and avoid mechanical failure of future nanostructure based components, the responsible mechanisms of defect nucleation and propagation induced by plastic deformation of these nanomaterials is also of considerable interest.

Within the framework of nano-mechanics, the successful candidate will study the elastic and plastic behavior of individual nanostructures by *in situ* atomic force microscopy in combination with nano-focused X-ray diffraction at 3rd generation synchrotrons (ESRF, SOLEIL, …). In addition, he/she will analyze defects in the mechanically deformed nano-objects using geometrically-aberration corrected high-resolution transmission electron microscopy using the FEI Titan available at the IM2NP in Marseille. The experiments will be accompanied by finite element method simulations.



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Applications including a CV, 2 letters of recommendations, and a letter of motivation should be sent to Thomas.Cornelius@im2np.fr. **Deadline: March 31st, 2016**