**École polytechnique, Laboratory for the physics of interfaces and thin films (LPICM)**

*Palaiseau, France*

**PhD position starting in February 2018: Crystallisation of silicon and germanium nanowires in the metastable diamond-hexagonal structure**

The Laboratory for the physics of interfaces and thin films (LPICM) has been a reference laboratory for plasma-enhanced chemical vapour deposition (PECVD) for the last 30 years.

At the heart of our activities is the NanoMAX project, where a **Cs-corrected transmission electron microscope combines ultimate spatial resolution with the possibility of aiming matter beams at the sample *in situ***. The matter sources include molecular beam epitaxy (MBE) sources and gas radical sources, which are unique worldwide. NanoMAX is part of Equipex TEMPOS.

The LPICM welcomes applications for a PhD studentship (standard stipend of about €1400 net per month during three years) for high-calibre graduates who hold a MSc degree in materials science or the physical sciences, who wish to study with NanoMAX the

**Crystallisation of silicon and germanium nanowires in the metastable diamond-hexagonal structure.**

The diamond-hexagonal phase (polytype 2H) does not appear in the phase diagrams of silicon or germanium. However, we have obtained silicon nanowires having that structure using the vapour-liquid-solid (VLS) growth method in a PECVD reactor [[1](#_ENREF_1)]. The calculated band structure of 2H Si makes it a better absorber of the solar spectrum than standard diamond-cubic (3C) silicon and its band gap would be direct in nanowires or under stress, which would give specific and interesting luminescence properties.

**The goal of the thesis** is to understand what stabilises this metastable phase during growth. The experimental work consists in the atomic-scale observation of the growth *in situ*, in the NanoMAX TEM. The observations will be coupled with ab-initio calculations and thermodynamic models of the growth (performed elsewhere in collaboration).

**How to apply.** Please send your CV and cover letter to jean-luc.maurice@polytechnique.edu by Friday 3rd November 2017.

**Websites**: https://portail.polytechnique.edu/lpicm/en/staff/research-team/nanosil-pvsixt-total/nanomax-seeing-nanostructures-growing-atom-atom

https://www.polytechnique.edu/annuaire/en/search/user/Maurice%20Jean-Luc

1. J. Tang, J. L. Maurice, F. Fossard, I. Florea, W. Chen, E. V. Johnson, M. Foldyna, L. Yu and P. Roca i Cabarrocas, *Natural occurrence of the diamond hexagonal structure in silicon nanowires grown by a plasma-assisted vapour-liquid-solid method*, Nanoscale **9**, 8113-8118 (2017).