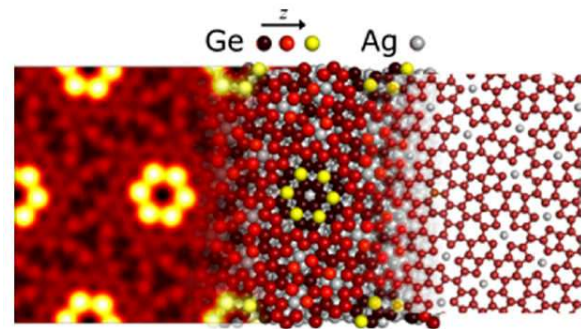


**Title:** Epitaxial growth of stanene

**Keywords:** 2D materials, epitaxy, structure, growth, STM, SXRD

**Scientific description:** Theoretical studies have shown that new physical properties such as tunable gap opening or quantum spin Hall effect could be expected from group IV graphene analogues (silicene, germanene, stanene) [1]. While there have been numerous studies of such Si, Ge, Sn monolayers, the demonstration of their hexagonal organization has been often based on post-growth characterization and their analogy to graphene has remained controversial. On the contrary, using real-time observation of the growth of such layers on metal surfaces with scanning tunneling microscopy (STM), we have evidenced unexpected surface alloying phenomena, that can lead to formation of buried layers, surface alloys or bulk alloys [2-4]

Thus, up to now, honeycomb, i.e., graphene-like silicene layers have only been identified for sure after growth on Ag(111) and Ag(110) [5], whereas Ge growth on Ag(111) leads to surface alloys (see Fig. 1) [6]. It has been recently proposed [7] that low-temperature deposition of Sn on Cu(111) leads to the formation of stanene.



Ge-Ag surface alloy on Ag(111) evidenced at INSP. [6]

The aim of the internship is to follow in situ and in real-time the deposition of tin on Ag and Cu surfaces with various substrate orientations to determine the relation between substrate symmetries and film structure. For this purpose, real-time STM experiments will be performed during Sn evaporation at various temperature. Surface X-ray diffraction experiments at SOLEIL synchrotron are also planned in February. The objective is to determine the structure and growth mechanisms of these novel 2D materials.

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**Techniques/methods in use:** Scanning tunnelling microscopy, Surface X-ray diffraction at synchrotron, Low Energy Electron Diffraction

**Applicant skills:** Scientific curiosity, knowledge of condensed matter physics

**Industrial partnership:** N

**Internship supervisor(s):** Geoffroy Prévot, [prevot@insp.jussieu.fr](mailto:prevot@insp.jussieu.fr), 01.44.27.46.53

**Internship location:** Campus Pierre et Marie Curie, Tower 22 – 4th floor, 22-12, 403

**Possibility for a Doctoral thesis:** Yes