PHD GRANT

# Doping engineering and characterization in germanium nanowires using in-situ transmission electron microscopy

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## LABORATORIES : NEEL, INAC

This PhD focuses on doping engineering and quantification using a metal phase propagation of aluminium in germanium nanowires (NWs), that can be performed in-situ in a transmission electron microscope (TEM). With this original approach, we expect to obtain exceptionally high doping levels in germanium, with concentrations beyond the limits imposed by the growth process of nanowires or thin films.

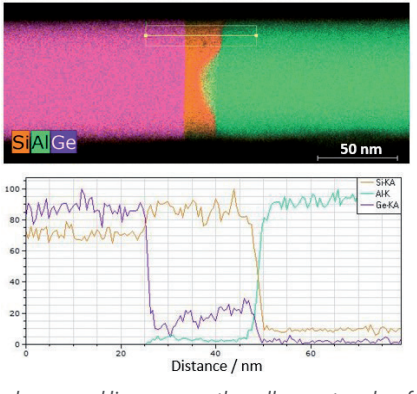


*Fig. : Chemical map, and line-scan on the yellow rectangle, of fabricated heterostructure with SiGe NW, Si region and Al reacted part.*

Minh Anh has improved the fabrication of contacted NWs on nitride membranes, a TEM compatible support. He uses energy dispersive X-ray spectroscopy to map the chemical composition and get more insight in the diffusion processes (figure), as well as TEM holography and electrical in-situ experiments to study the electrical properties of these nano-materials and potentially make a correlation with their composition. While we can't yet conclude on the doping engineering aspect, Minh Anh has obtained exciting results on propagating Al in SiGe alloy NWs. In these structures, a silicon rich region is created at the interface between the Al contact and the remaining SiGe alloy NWs. This is potentially a powerful method to fabricate contacted quantum dot heterostructures, and this will be explored in more detail.

## OUTCOMES

**Presentation** to IMC conference, Sydney, Australia, 2018.

**Collaboration:** M. Sistani, A. Lugstein, Vienna Technical University, Austria.

**Leverage:** ANR project COSMOS and e-See, ERC project e-See.