	Experiment title: Toward the origin in Ni-based germano-silicides thermal degradations	**Experiment number**: MA-2406
Beamline: ID16A	**Date of experiment**: from: 31October 2014 to: 04th November 2014	**Date of report**: 10/09/1025
Shifts: 12	**Local contact(s)**: P. Cloetens	*Received at ESRF:*

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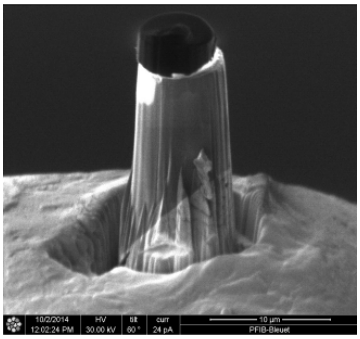
Report:

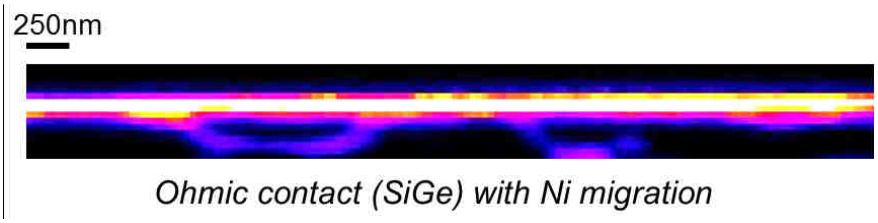
This experiment aimed at performing a 2D depth-resolved chemical imaging of ohmic contact for CMOS transistors. Typically, chemical species of interest include Ni, Si, Ge or Co. Previous experience existed using atom probe tomography (see proposal), but this method is far too local (100nm) to have stasticical and reliable analysis. X-ray fluorescence nanotomography, on the other hand allow to produce sub-100nm chemical images of samples as thick as 10 micrometers or even more.

In this context, prior to the experiment, tips of 10-20 micrometers in diameter were prepared using plasma-FIB, as can be seen on the figure of this report. The top layer (black one) is of no interest: it is just a protecting layer. A series of such samples were prepared, with different annealing temperatures (400°C, 600°C and 700°C), and with different composition (Ni, NiPt, NiCo), plus a pure Ge crystal for calibration purpose.Every sample was scanned using the 1st generation scanner method (linear raster scan- rotation), with typically a 20nm step and a 3° angular step, and with the minimum dwell time possible on the beamline (50ms). Due to a drift of the experiment, we could not perform series of 2D slices, but series of 2D projections separated by angular motion, to make sure that the interesting ROI was imaged for every angle.

After fitting data, performing the reconstruction with self absorption correction, we could manage to produce chemical maps of our samples. In the figure below is shown a projection of the Ni distribution. The (very) interesting thing is that we could evidence the migration of Nickel in the matrix, that could be encroachment, which is usually observed using electron microscopy. A lot of data still need to be processed, and publication is targeted.

Except for the rotation issue, the beamline (operating at 17keV) at that time, turned out to be very stable; the procedure to change the sample is somewhat tedious but ensure the setup will remain clean and stable with time. On top of that, great improvement of been performed since then, which makes this operation much faster and secure. The controlling of the experiment is professional and the support of the beamline staff is perfect.





Ohmic contact (SiGe) with Ni migration

Sample prep (left) and fluorescence of Ni (right) showing migration.