FROM RESEARCH TO INDUSTRY

cea tech

leti

PHD FOR 3 YEARS AT CEA GRENOBLE, FRANCE

TECHNIQUE DEVELOPMENT FOR SIMULTANEOUS STRAIN AND CHEMICAL COMPOSITION MEASUREMENT AT NANOSCALE

Collaboration framework and context

Strain engineering in advanced microelectronic devices allows for a substantial increase of carrier mobility in active layers. The advances in this field, especially for ultra-scaled devices or 3D architectures such as stacked nanowires must be supported by improvements in local strain characterization techniques. Substrate engineering, in particular the growth of epitaxial silicon (Si) and germanium (Ge) layers, is actively contributing to these advances and, as a consequence, require an accurate, local quantification of these elements. Here, the purpose is to develop a quantitative analysis for the nanoscale mapping of strain and Si-Ge concentrations compatible with the most advanced semiconductor devices. This work will be done in collaboration with StMicroelectronics.

Work description

The combined analysis of strain and chemical composition will be performed using the "precession" mode in a transmission electron microscope (TEM). Indeed, CEA has recently introduced the use of precession nanobeam electron diffraction for the strain measurement with a 0.03% precision. Moreover, the beam precession substantially reduces the electron channeling effects which restrict the precision in elemental quantification by X-ray energy dispersive spectrometry (EDX). In parallel, the new SDD (Silicon Drift Detector) technology of EDX detectors allows the acquisition time to be reduced from hours to minutes. In particular, this study aims at implementing, synchronizing and acquiring in the TEM using the precession mode both diffraction patterns for strain measurement and EDX spectra for chemical analysis. A specific focus will be placed on the benefits of precession in improving the precision of chemical quantification. The new method will be implemented at the Nanocharacterization Platform (PFNC) in CEA Grenoble using a recently acquired probe-corrected FEI Themis TEM equipped with an X-FEG and SDD technology for the EDX analysis.

Starting date

First quarter 2016

Contacts: CEA | LETI | DTSI | SCMC
Nicolas Bernier | T. +33 (0)4 38 78 47 67 | nicolas.bernier@cea.fr

Commissariat à l'énergie atomique et aux énergies alternatives
MINATEC Campus |17 rue des Martyrs | F-38054 Grenoble Cedex