Three dimensional investigation for the 22-nm-node and beyond: surface morphology of gate-all-around transistors by atom probe and electron tomography.

A. Grenier[1,], D.Cooper[1], J.P. Barnes[1], K. Tachi[1], T.Ernst[1] , S. Duguay[2], E. Cadel[2], F.Vurpillot[2], D. Blavette[2], A. Chabli[1], F. Bertin[1]*

[1] CEA-LETI, MINATEC Campus, 17 rue des Martyrs-38054 Grenoble Cedex 9, France.
[2]Groupe de Physique des Matériaux, UMR 6634 CNRS —Université de Rouen, BP 12, 76801 Saint Etienne du Rouvray Cedex, France.

ABSTRACT

Gate-all-around (GAA) Si nanowire transistors are promising candidates for future CMOS devices [1]. They present a low off-state leakage current and offer high performance for sub-22 nm technologies [2]. The fabrication of such devices involves the conformal deposition of the gate stack directly around etched semiconductor Si nanowires. It is known that electrical properties of these devices are directly linked to the morphology and roughness of nanowires [3]. In this poster, we will show that the combination of electron tomography and atom probe tomography allows a fully 3D morphological characterization of the GAA devices, as it shows on the figure 1. Atom probe tomography, based on the field effect evaporation, is the only technique capable of chemically quantifying at the atomic-scale resolution in three dimensions, as it has recently demonstrated in semiconductors [4].

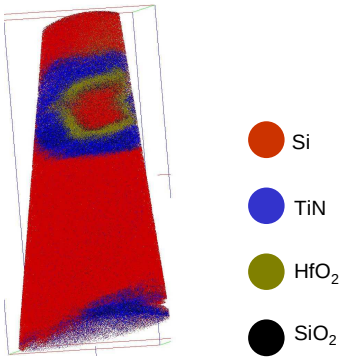

Fig.6: 3D reconstruction of GAA device by atom probe tomography.

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Keywords : Gate-All-Around, morphology, electron tomography, atom probe tomography.