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Abstract

Due to their exceptional properties, 2D materials (2DM) are intensively studied for a large spectrum of applications as FET for more Moore developments, sensors, NEMS, optoelectronic or photonic but also more recently for quantum technology. Unlike silicon, 2DM do not suffer from the short channel effect and then could be ultimate material for nanosheet FET. Exceptional performances can be obtained at device level. However, the upscaling required further developments.

In this talk, an overview of the challenges to go from the lab device to the large scale manufacturing. 2DM cannot be industrially processed exactly as silicon and some adaptations have to be found to be able to process them in silicon fab. Indeed, the self-passivated nature of 2D materials required developments to preserve their properties and avoid any damage during the steps like deposition onto 2DM, etching or cleaning. Specific processes are developed allowing an atomic precision. Another key point is the transfer of 2D material from growth substrate to final substrate. Large scale growth made recent progress and processes for good quality of 2D material up to 300 mm wafers already exist. However, the growth temperature is often higher than 700°C, 2DM cannot be deposited during the device manufacturing then have to be transferred by wafer bonding technology. Nanoscale characterization is also a key factor to prepare the large scale integration. Eventually, characteristics of promising devices will be shown as example of 2D material capability for the future of microelectronics.