Recent developments in Atomic Scale Processes for advanced semiconducting and superconducting devices

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The recent COVID19 pandemic has shed light on the global worldwide chip shortage affecting numerous industries such as automotive goods, computers, consumer electronics and household appliances. Four years later, the Ukrainian war coupled with the increasing demand for PCs and mobiles due to the development of 'stay-at-home' work continues to greatly impact most manufacturers requiring integrated circuits (automotive, consumer goods, IoT and information/communication technologies etc), causing in turn extensive disruptions in supply chains and unbearable price increases. For this reason, chip manufacturers worldwide have massively engaged into chip acts within the past years, involving tremendous financial investments to sustain fab capacity expansions and fostering high volume manufacturing (HVM) of more than Moore devices (MEMs, sensors, power devices, photonics…) to satisfy the high demands.

In this context, miniaturization of devices along with the development of systems in package and systems on chips is gaining a growing interest from chip manufacturers and fabrication requirements in production lines are becoming more stringent, with ever-increasing device architectures and processing complexities. Ever since its first implementation in HVM back in 2007 (Intel Inc.), the Atomic Layer Deposition (ALD) technique has been an exponentially growing solution to meet such requirements, thanks to its unequaled benefits for innovative device elaboration: fully conformal and nanometer-scale thickness controlled thin films with excellent uniformity over large surface areas, even on shaded surfaces. Its counterpart Atomic Layer Etching process is also a very intense research and development subject, both processes enabling structuration of materials at the atomic scale with a very high precision.

In this seminar, I will present the latest results that we have obtained at LTM laboratory in Grenoble, dealing with the developments of atomic scale processing issues.