Nanofabricated Silicon Devices: From Nanosensors to Medical Implants

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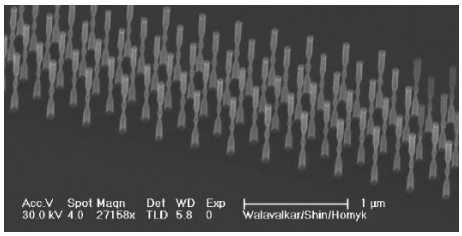
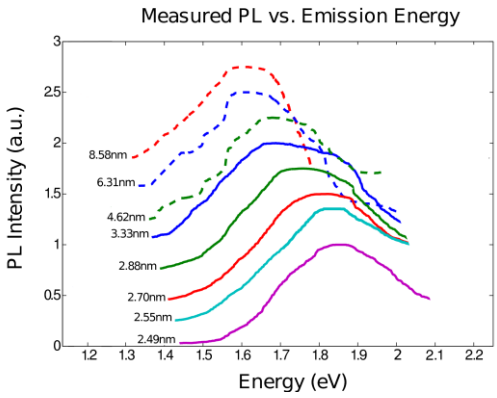


Advances in the silicon fabrication and the resulting miniaturization of devices have fueled the rapid evolution of microelectronic devices over the past decades. More recently, silicon has also emerged as an opto-electronic material, and its mechanical strength has found widespread use in mechanical devices. The manufacturability of high resolution silicon micro- and nanostructures is unparalleled, and the control over the precise geometry of silicon devices has followed the predictable path of Moore's law. In anticipation of the evolution of this trend, we will describe the opportunities of reducing the sizes of silicon devices to below 10nm to control mechanical, optical and electronic properties of silicon. We will show some examples of nanostructures with dimensions below 10nm not only in lateral dimensions, but also through 3-dimensional etching in all dimensions. This control will enable "geometric bandgap engineering", leading to many interesting devices with optical, electrical and mechanical opportunities.



As the size of devices is reduced, it is possible to contemplate their integration within more complex integrated systems. During the second part of the presentation, the opportunities for such integrated systems will be explored. The combination of power supply, data communications and detectors enables us to contemplate microsystems for healthcare monitoring. Such systems, which could be implanted as neural probes or metabolic monitors, will enable the continuous wireless measurement within patients and may ultimately lead to a reduction in cost of our medical care.