

Semiconductor nanowires : elaboration, analyses and applications

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Semiconductor nanowires are nano-objects with a high aspect ratio and a sub-micrometre diameter (Fig. 1 (a) and (b)). These nanomaterials are intensively studied as promising building blocks of future photonic and electronic devices (e.g. transistors, sensors, photovoltaic converters, light emitting diodes, photodetectors...). They are also unique systems to study fundamental physical phenomena at the nanoscale. The nanowires exhibit unique optical and electrical properties stemming from their anisotropic geometry, high surface-to-volume ratio, and carrier confinement.

The nanowires can be fabricated either by a top-down or a bottom-up approach. The main advantage of the bottom-up nanowire synthesis is the possibility to reduce the object dimensions disregarding the limitations imposed by the lithographic techniques while preserving lateral surface flatness.

In this talk, the elaboration, characterization and applications of bottom-up semiconductor nanowires will be discussed. We will first discuss the nanowire epitaxy and different structures that can be obtained. We will then present some nanoscale characterization techniques allowing to get access to the nanowire physical parameters. Finally, we will focus on the nanowire optoelectronic applications with a special attention to light emission and energy harvesting. In particular, mechanically flexible nanowire light emitting diodes will be highlighted (Fig. 1 (d) and (e)).

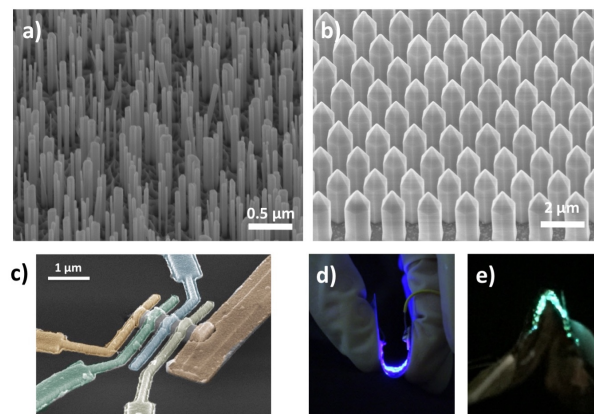


Figure 1 : SEM images of (a) – self-assembled and (b) – organized GaN nanowires; (c) nanowire with multiple electrical contacts; (d) blue and (e) green flexible nanowire light emitting diodes