VLS growth of GaSe nanoribbons by MOCVD

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Two-dimensional materials present specific properties most of the time at a monolayer level. The III-VI layered semiconductors family are remarkable due to the fact that these properties are obtained for several layers, making their integration in devices more feasible [1]. Among them, gallium selenide (GaSe) presents a direct bandgap of 2 eV which can be tuned with the number of deposited layers making it good candidate for photodetection applications [2]. Currently, the fabrication methods are mainly based on exfoliated process and single device can be produced. Indeed, there is a lack of large scale, good crystalline quality, elaboration method for 2D materials in general. An alternative could be to work with one-dimension nanostructures which present a large active surface and are very good crystalline quality [3]. Coupling 2D materials and nanostructures could enhance devices' performances.

In this work, we demonstrate the vapour-liquid-solid growth of GaSe nanoribbons (NR) on 300 mm SiO2/Si substrates by MOCVD. Indium droplets are used to initiate the catalytic growth. GaSe NRs are hundreds nanometres wide and hundreds micrometres long. Their crystal quality has been investigated by STEM/TEM and no defect could be observed. A bandgap energy of 1.9 eV has been measured by photoluminescence on both isolated and several grouped NRs. After the growth, the NRs are detached from their original substrate and dropcasted on a host substrate where single NR has been contacted for electrical characterization. Photoresponse of the device has been characterized by I(V) and I(t) measurements.

References

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