Soutenance de thèse

“Novel substrates for growth of III-Nitride materials”

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A major advantage of semiconductor nanowires (NWs) is the possibility to integrate these nano-materials on various substrates. This perspective is particularly attractive for III-nitrides, for which there is a lack of an ideal substrate. We examined the use of novel templates for growing GaN NWs by plasma assisted molecular beam epitaxy. We explored three approaches with a common feature: the base support is a cost-efficient amorphous substrate and a thin crystalline material is deposited on the support to promote epitaxial growth of GaN Nws.

In the first approach, we formed polycrystalline Si thin films on amorphous support by a process called aluminum-induced crystallization (AIC-Si). The conditions of this process were optimized to get a strong [111] fiber-texture of the Si film which enabled us to grow vertically oriented GaN NWs. The same idea was implemented with graphene as an ultimately thin crystalline material transferred on SiOx. We illustrated for the first time in literature that GaN NWs and the graphene layer have a single relative in-plane orientation. We propose a plausible epitaxial relationship and demonstrate that the number of graphene layers has a strong impact on GaN nucleation. Proof-of-concept for selective area growth of NWs is provided for these two approaches.

As a simple approach, the possibility of growing NWs directly on amorphous substrates was explored. We use thermal silica and fused silica. Self-induced GaN NWs were formed with a good verticality on both substrates.

Based on our observations, we conclude that the epitaxial growth of GaN NWs on graphene looks particularly promising for the development of flexible devices.

Composition du jury :

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