

Molecular beam epitaxy growth and optical characterization of GaN on graphene/GaN substrate

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PhD may follow: Yes

Summary :

Among the multiple advantages of graphene, its use as a substrate for nitride semiconductors is particularly attractive: besides allowing the epitaxial growth of these technologically important materials on any substrate, graphene promotes an elastic decoupling of the epitaxial layer from the substrate with the subsequent advantage of minimizing or even suppressing the crystalline defect formation (for instance dislocations) associated with the lattice mismatch with the substrate and concomitant elastic strain relaxation. This is particularly true for nitride semiconductors (GaN and alloys) which are the building block of white LEDs, more and more used those days in the context of energetic transition. Along these lines, we propose to use the concept of "remote epitaxy" to grow high quality GaN layers. For this purpose a layer of graphene will be deposited on a thick GaN substrate (in collaboration with the Systèmes Hybrides de basse dimensionalité team of Institut Néel). Next, GaN will be grown on this substrate by molecular beam epitaxy (in the laboratory INAC/PHELIQS/NPSC of CEA-Grenoble). Due to the very small thickness of graphene (one monolayer), we expect that the epitaxiated layer will keep the "memory" of the substrate and grow in monocrystalline form. But we also expect that this monolayer of graphene will ensure a sufficient elastic decoupling from the substrate to avoid the transfer of the dislocations from the substrate to the epitaxiated layer. Then, our goal is to finally obtain a material of excellent crystalline and optical qualities and contribute to overcome an enduring problem inherent to nitride materials, which has still to be solved in spite of the international progress registered in the field.

Requested skills :

interest in experimental science. Curiosity. Interest in material science