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Hydride vapor phase epitaxy of III-V semiconductor nanostructures and nanowires

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Hydride Vapor Phase Epitaxy (HVPE) process exhibits unexpected properties when growing III-V semiconductor nanowires. With respect to the classical well-known methods such as Metal Organic Phase Epitaxy (MOVPE) and Molecular Beam Epitaxy (MBE), this near-equilibrium process based on hot wall reactor technology, enables the synthesis of nanowires with a constant cylinder shape over unusual length and free of crystal defects with great optical properties. The potential of Vapor Liquid Solid (VLS) growth in the HVPE environment was demonstrated in the group to produce monocrystalline pure cubic rod like $\langle 111 \rangle$ GaAs ultra-long nanowires, 100 μm long with constant diameter of 120 nm in 15 minutes of growth. This behavior is now confirmed for GaAs nanowires with diameters in the range of 10-30 nm and lengths of 35 μm with accurate thermodynamics modeling. HVPE growth process was also developed for nitrides. Tens of micrometers ultra-long GaN nanowires with diameters in the range of 30-80 nm were grown by VLS-HVPE. These Nanowires oriented along [0001] direction exhibited pure wurtzite structure free of stacking faults and exceptional optical. Selective Area Growth (SAG) is of highest interest. Benefiting from HVPE features, record high-aspect-ratio GaAs nano-grating lines were synthesized. In the field of III/V semiconductor integration on silicon, highly oriented GaN rods arrays with great optical properties were grown on patterned silicon substrates as building blocks for high quality core shell LED structure.

Biography

Yamina Andre has completed her PhD at the age of 25 years from Blaise Pascal University (France). She is now an Assistant-Professor at the Pascal Institute (France) and an expert in developing the HVPE (Hydride vapor Epitaxy) growth process to III-V semiconductor materials. Today only few groups in the world continue to develop this process to semiconductor nanostructures and nanowires. Her recent papers in reputed journals proved the high potential of this growth process in the field of nanoscience.

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