The epitaxial growth of III-N semiconductors in non-or semi-polar orientations avoids the effects associated with the existence of internal fields in GaN-based hetero-structures usually epitaxially grown in the c-direction. The thesis work that we will present is part of the research for ways to optimize the crystalline structure of epitaxial layers in <10-11> semi-polar directions on disoriented silicon substrates of 7 ° compared to the direction <001>. An appropriate structuring of these substrates of particular orientation makes it possible to reveal <111> orientation inclined facets on which the GaN epitaxies in the direction C. The number of emergent dislocations, created at nucleation , is then directly proportional to the surface of these facets of Si <111>. Reducing the density of dislocations to low levels as obtained on sapphire substrate requires therefore reduce the size of the nucleation facets. The original solution we have developed is to use SOI substrates for which the upper layer of Si (above the BOX) is disoriented by 7 ° with respect to the <001> direction and is as thin as possible, reducing by makes the impression of the substrate. Optimization of both the substrate structuring process and the growth stages allowed us to reduce the emerging dislocation density in GaN <10-11> semipolar layers by a factor of 10 compared to state of the art on Si substrate. The residual stress, in tension when on Si, is here almost zero. Reduction of the nucleation surface has also resulted in the elimination of the "melt-back etching" phenomenon, usually impossible to prevent for semi-polar epitaxial layers on Si substrates. We will also show that the use of the so-called "Aspect Ratio Trapping", implemented for cubic symmetry materials is directly applicable to the case of semi-polar nitrides (which are of hexagonal symmetry) when epitaxied on SOI, causing another factor 10 in the reduction of the density of dislocations.

Lastly, we used these semi-polar low-density dislocation layers to make metamorphic InGaN layers, that is to say elastically relaxed and whose misfit dislocations are aligned along the interface. . Stress relaxation allows for greater incorporation of indium for the purpose of producing longer wavelength diodes. In this sense, we demonstrate the realization of the first semi-polar LED made on SOI substrates.