Insights of Neutral Beam Etching of GaAs materials for quantum nanodisks fabrication

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III-V semiconductor compounds, and particularly GaAs, have been studied for a few decades due to their photonic device applications [1]. Recently, fabrication of quantum dots (QD) with such materials for next-generation photonic devices enhanced the attractiveness of III-Vs. However, the realization of QDs is not straightforward and the usual bottom-up approaches are facing big issues. On the other hand, top-down approaches such as reactive ion etching (RIE) are difficult to foresee because of the generation of defects during the process. We have already presented our solution consisting in the combination of a Bio-Nano-Process (BNP) and a Neutral Beam Etching (NBE) process [2, 3]. Here, we will discuss insights of our processes, focusing on the relation of the surface state and the NB characteristics.

A chlorine NB is used for etching GaAs-based multiple quantum well layers (GaAs/AlGaAs or InGaAs/GaAs). It has been shown that NBE is a low activation energy process and really sensitive to the residual surface oxide [4]. To gain a better insight into the etching mechanisms, we purposely investigated the chlorine NB characteristics (pressure, neutral energy, etc) with respect to the etching results obtained during nanopillars fabrication, like the one shown in Fig. 1.

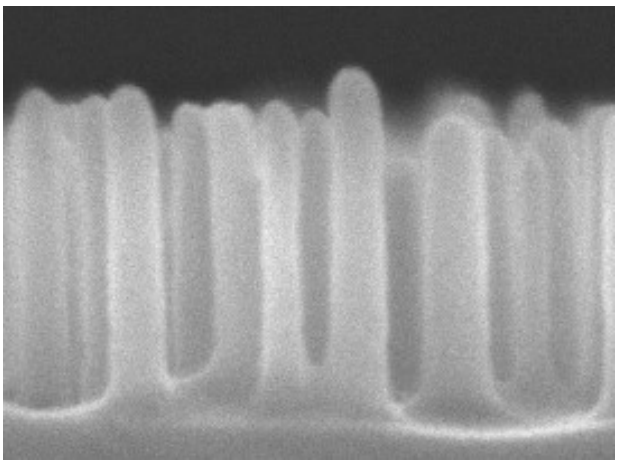

Fig. 1 Nanopillars of GaAs/AlGaAs stacked layers etched by Cl_2-NBE.

References

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