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Etching of GaAs materials by chlorine neutral beam for quantum nanodisks fabrication CEDRIC THOMAS, AKIO HIGO, TAKERU OKADA, SEIJI SAMUKAWA, Tohoku University — Quantum dots (QD) fabrication is still challenging, either from bottom-up or top-down approaches. We have combined a Bio-Nano-Process (BNP) and a Neutral Beam Etching (NBE) process to make nanopillars, embedding GaAs quantum nanodisks. Using BNP, a self-assembled monolayer array of nanoparticle is deposited on the GaAs surface to form a nanometer size etching mask array. NBE by chlorine neutrals of GaAs is subsequently performed, enabling low-damage etching of nanodisks. During the fabrication process, insights of NBE mechanisms were investigated. It has been found that NBE was really sensitive to the surface oxide, so the nanopillars fabrication needed a good control of surface oxide and NBE parameters. By studying NBE of GaAs with respect to substrate temperature, it was found that NBE has a low activation energy. In the case of RIE within the same condition, a lower activation energy was estimated. It is assumed that the residual oxide on the surface is the main cause for such behavior. Tuning steps prior etching such as hydrogen radical treatment, have been successful for the fabrication of nanopillars. NBE and RIE have shown same order characteristics, however NBE process enables low-damage nanostructures compared to RIE, which is promising for next generation QD devices.

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