TW1-01

Development of quantum dot site control process base on AFM tip-induced nano-patterning and their applications

Jong Su Kim

Advance Photonics Research Institute, GIST

Recently, there have been many proposals for the device applications of semiconductor quantum dot (QD) nano-structures, such as single-photon emitters for quantum communication and quantum dot cellular automata for logic devices. In particular, for the application of the quantum devices, it is necessary to fabricate site-controlled and highly aligned artificial nano-structures with high quality. Many research works for the fabrication of site-controlled QDs by regrowth techniques have been carried out by using electron-beam (EB) lithograph combined with Cl_2 gas etching and scanning tunneling microscope tip-assisted patterning and overgrowth process, which are based on the surface modification to fabricate a nucleation site such as nano-holes. To fabricate site-controlled QDs with high quality, it is important to get the nano-holes with defect and contaminant free regrowth-interface as a nucleation site. However, the main problem related to all such patterning and regrowth processes is the introduction of interface contamination and defects caused by chemical and physical process such as energetic EB lithograph. To overcome these problems, it is necessary to develop novel patterning process and etching/cleaning methods for defects and contaminants free regrowth-interface.

In this work, I suggest a promising way to fabricate high quality site-controlled QDs based on patterning and regrowth process, which can reduce the surface physical defects and the interface contaminants between QDs and template to the negligible level by using the combination of atomic force microscopy (AFM) tip-induced nano patterning, atomic hydrogen etching/cleaning and regrowth of InAs QDs by droplet epitaxy method.