The effect of In0.1Ga0.9As underlying layer on the structural properties of self-assembleD In0.5Ga0.5As quantum dots

Abstract:

The effect of a thin In0.1Ga0.9As underlying layer on the structural properties of single layer In0.5Ga0.5As quantum dots (QDs) was investigated using atomic force microscopy (AFM), transmission electron microscopy (TEM) and high-resolution X-ray diffraction (HR-XRD) characterization. The size of dots formed on the surface is uniform but the density increases with the addition of In0.1Ga0.9As underlying between In0.5Ga0.5As QDs and GaAs buffer layer. This is consistent with the TEM characterization. The existence of thin underlying layer has caused the dots to have different crystal orientation as shown in TEM characterization. From the HR-XRD characterization, broad peak of In0.1Ga0.9As underlying layer and QDs has been observed. The wider width of the layer peak than the expected one has been attributed to the strain-relaxation-induced defects. The growth of a thin In0.1Ga0.9As underlying layer in the In0.5Ga0.5As/GaAs structures strongly affects the structural properties, which was also believed to influence the optical properties of QDs.