The epitaxial growth of multi-component semiconductor layers such as Ga(N\textsubscript{x}As\textsubscript{y}P\textsubscript{1-x-y}) enables the improvement of laser and transistor devices because of the tunable band gap and lattice constant. However, many physical aspects of the formation such complex materials are still unknown and the determination of the chemical composition as well as understanding of the local effects pose a true challenge for an investigator.

In order to improve optical properties according to the earlier experiments [1] post-growth annealing is applied to the multi-quantum well (QW) heterostructures. The look inside the material and especially the advantage of the high resolution attainable in scanning transmission electron microscope (STEM) can answer the question, what influence the annealing treatment has on the specimen on the atomic scale. We investigated Ga(N\textsubscript{x}As\textsubscript{y}P\textsubscript{1-x-y})-quantum wells in the Si-based laser structures. The investigations were performed using a double Cs-corrected JEOL JEM 2200 FS. The annular dark-field STEM-images of the annealed specimens reveal local structural changes in the Ga(N\textsubscript{x}As\textsubscript{y}P\textsubscript{1-x-y})-QWs, that were not observed in the specimens without a thermal treatment. In order to understand and to explain the nature of these changes as well as a possible reason of their appearance a series of the high resolution STEM-images were acquired for different detector angular ranges. The intensities in the experimental images were evaluated using in-house written software. To prove the interpretation of the experimental results several simulations based on the absorptive potential [2] and frozen phonon [3] methods were carried out and compared with the experimental contrast.


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