Abstract

The semiconductor system CdSe/ZnSe is a promising candidate for the fabrication of optoelectronic devices in the blue and blue-green spectral range. The exchange of conventional two-dimensional structures by zero-dimensional structures (Quantum Dot Structures QDS) in the active layer of the device can overcome the disadvantages of the structural properties of the II-VI semiconductors (degradation).

With Molecular Beam Epitaxy (MBE) up to three monolayers (MLs) of CdSe are deposited on a ZnSe layer. Cd-rich inclusions (type A-islands) with diameters of 5 nm form inside of the CdSe wetting layer. The density of the type A-islands ($10^{11}\mathrm{cm}^{-2}$) shows no dependence on the CdSe coverage, whereas the Cd-content increases with the deposition.

CdSe-islands with diameters of 16 nm are formed in a self-assembled Stranski-Krastanow (SK) growth process (type B-islands or SK-islands). The density of the type B-islands increases with the CdSe coverage, whereas the Cd-content (90%) shows no dependence on the deposition.

The formation process of both island classes is investigated by using different substrates and varying the growth parameters. The type A-islands can be avoided by use of vicinal substrates (6°) or under metal-rich growth conditions. For the type B-islands a growth window of 2-3 MLs CdSe coverage was found. With less CdSe, the formation process does not occur, a larger coverage results in relaxation of the CdSe layer with formation of stacking faults.

By replacing the stabilizing selenium atmosphere with a sulphur atmosphere, i. e. formation of CdS instead of CdSe, the lattice mismatch of -7.5% is reduced to -3.9%. The fully strained type B-islands degenerate, which shows the reversibility of the SK growth process in the system CdSe/ZnSe.