

INDIUM CLUSTERS EVOLUTION IN A InGaN/GaN QW

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Nitride semiconductors (GaN, AlN and InN) have been extensively studied due to its superb optoelectronic properties. Blue light-emitting devices or ultra-high frequency transistors compose only two of the wide range of technical applications. Nitrides are grown on various substrates with large misfits what may lead to a high density of defects or a strong composition fluctuations at the atomic scale. In particular, an active area for a blue LED or blue lasers are made of a multiple GaN/InGaN/GaN quantum wells (QW) and presence of the indium rich clusters in a QW area is reported, see Fig. 1. From this point of view, the knowledge about the cluster formation mechanism, its evolution and their role on the optical properties of the nitride based heterostructures is crucial. To this end, a quantitative high resolution transmission microscopy (HRTEM) is coupled with a stress induced diffusion in a finite element method (FEM).

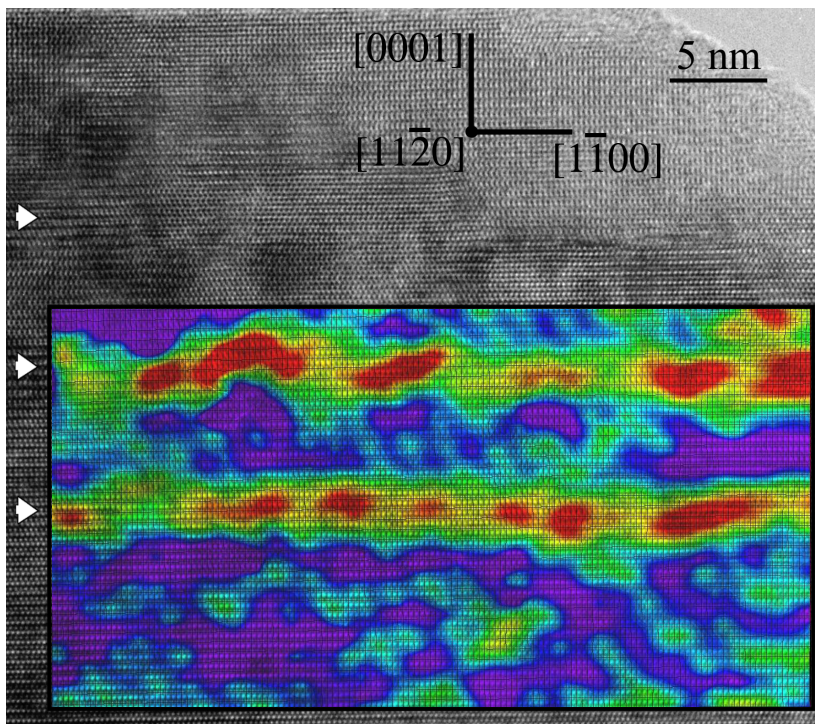


Fig. 1. HRTEM image of the MOCVD InGaN/GaN heterostructure. Black frame denotes evaluation area for a lattice distortion.

On the basis of the real indium clusters in InGaN/GaN QW a computer simulation has been performed for the stress induced diffusion process. Taking into account the geometry, position and composition of indium clusters as a starting configuration for FE initial-boundary problem we calculated subsequent configurations of indium cluster tending to the normalization of stresses. The elastic energy stored in HRTEM sample and its evolution in time has been analyzed. In particular, different position of the clusters towards the samples free surface (TEM sample) were analyzed to find the most preferable configuration taking into account elastic energy of the sample, see Fig. 2.

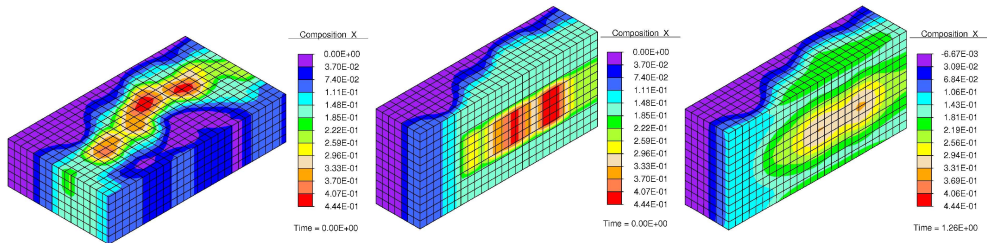


Fig. 2. FEM modeling of stress induced diffusion in a InGaN/GaN QW. Initial and final configuration.

References

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