Optical properties of ZnO/ZnMgO quantum wells grown by PAMBE

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Zinc oxide is considered to be a good candidate for applications in blue and UV optoelectronics due to its properties (3,37 eV direct band gap and high exciton binding energy - 60 meV in bulk ZnO and up to 100 meV in ZnMgO/ZnO/ZnMgO quantum wells). In this work we employ various techniques to investigate optical and structural properties of ZnMgO/ZnO/ZnMgO quantum wells grown by plasma assisted molecular beam epitaxy.

These structures were grown on (0001) sapphire substrates, that were annealed in oxygen prior to the growth. The width of QWs ranged from 2 nm to 9 nm while magnesium content in ZnMgO barrier layers was kept between 10% and 20%. The crystalline quality and surface morphology were investigated both *in situ* (with reflection high energy electron diffraction and *ex situ* (with X-ray diffraction and atomic force microscopy). XRD measurements show good crystalline quality and no phase separation, while RHEED and AFM images confirmed very good flatness of the surface with rms value below 2 nm. Subsequently photoluminescence (PL) and time-resolved photoluminescence (trPL) spectroscopy were used to investigate optical properties of these samples. These measurements allowed us to observe Quantum Confinement Effect in structures with thin QWs (up to 4 nm) and Quantum Confined Stark Effect in thick QWs (above 4 nm). Exemplary results of trPL experiment for structure exhibiting QCSE are shown in figure 1.

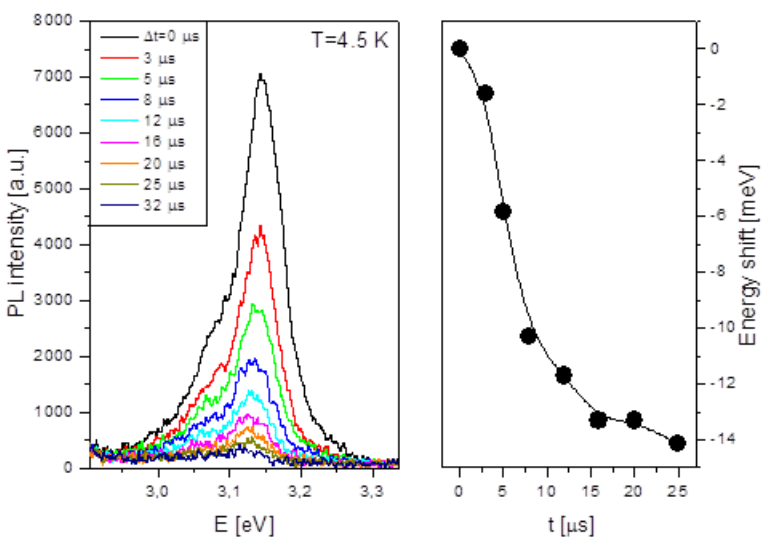

Fig. 1 trPL spectrum and main PL peak energy shift with time for structure with 9 nm QW