Optical investigation of coupled double asymmetric $ZnO/Mg_xZn_{1-x}O$ quantum wells grown on nonpolar substrates by MBE

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ZnO/ZnMgO heterostructures grown on Al_2O_3 or Si substrates are well known materials for UVemitting devices. However, the large lattice constants misfit between ZnO and these substrates is an inevitable obstacle in obtaining high quality quantum well (QW) structures. Crystaline ZnO substrate is a possible way to overcome the mismatch problem.

Here we present results on high quality $ZnO/Zn_{1-x}Mg_xO$ Asymmetric Double Quantum Wells (ADQW) structures grown by Plasma Assisted Molecular Beam Epitaxy on nonpolar sapphire and ZnO substrates. The barrier thickness in the structures varies from 2 to 25 *nm* and the Mg content is between 20 to 30%. Cross-sectional SEM and CL imaging, confirmed the assumed combined widths of whole quantum structure. Rutherford back scattering and channeling gave information about crystallographic quality of the investigated structures.

The power dependent photoluminescence (PL) measurements confirm absence of build-in electric field acting upon the excitonic transitions in the QW structures. The PL experiments in temperature dependency have provided the data to analyze the behavior of excitonic emission from ZnO substrate, QWs and ZnMgO barriers. Experiments show that the binding energies of excitons confined within the QWs are reaching up to 100 *meV* for thin 2 *nm* QW. Coupling of ADQWs is observed for structures separated by barriers up to 7 *nm* thick. The observed dispersion of the PL decay time constant clearly demonstrates strong localization within the narrow wells (up to 3 *nm*), while it is much weaker in wider ones. Time-resolved photoluminescence measurements bring evidence for coupling between the QWs separated with the up to 7 *nm* thick ZnMgO barrier. This is in some disagreement with theoretical calculations, which suggest mauch smaller barrier thicknesses [1]. The activation energies of QW and FWHM have been calculated from both PL and TRPL measurements.

[1] J. Zippel, M. Stolzel, A. Muller, G. Benndorf, M. Lorenz, H. Hochmuth, M. Grundmann, Phys. Status Solidi B, **247**, 2, 398, 2010.

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