

# ZnO/Zn<sub>1-x</sub>Mg<sub>x</sub>O multiple quantum wells on vertical ZnO microrods - cathodoluminescence studies

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We report on an innovative two-step method for the synthesis of axial quantum Zn<sub>1-x</sub>Mg<sub>x</sub>O/ZnO/Zn<sub>1-x</sub>Mg<sub>x</sub>O structures built into a ZnO microrod. ZnO microrods have been prepared by the microwave-assisted hydrothermal method and then overgrown by plasma-assisted molecular beam epitaxy technique which has been employed for control of well width and compositions of the axial quantum heterostructure.

To study local optical properties, cathodoluminescence (CL) spectrum line scans have been recorded for a number of the axial multiple quantum well (MQW) heterostructures. Example of results is seen in Fig. 1(a). The orientation of the line scan is presented in Fig. 1(b). The ZnO QWs with different thicknesses and the ZnMgO layers are located on the top end of the microrod. The CL line scan shows the spatial distribution of the emission bands with respect to the position on microrod. The CL emission spectrum from the upper part of the microrod heterostructure (Fig. 1(c)) consists of a set of peaks related to the emission from the QWs with different thicknesses and the peak at 3.60 eV ascribed to recombination in ZnMgO barriers. The spectra measured at the bottom of the microrod, where no QW or barrier are present, show only the ZnO emission band at 3.35 eV related to recombination of the donor bound exciton.

In conclusion, the presence of the axial heterostructure grown on the ZnO microrods is confirmed by low-temperature CL. Luminescence lines are observed at the spectral positions expected for the QW and barrier emissions from the top part of the microrods.

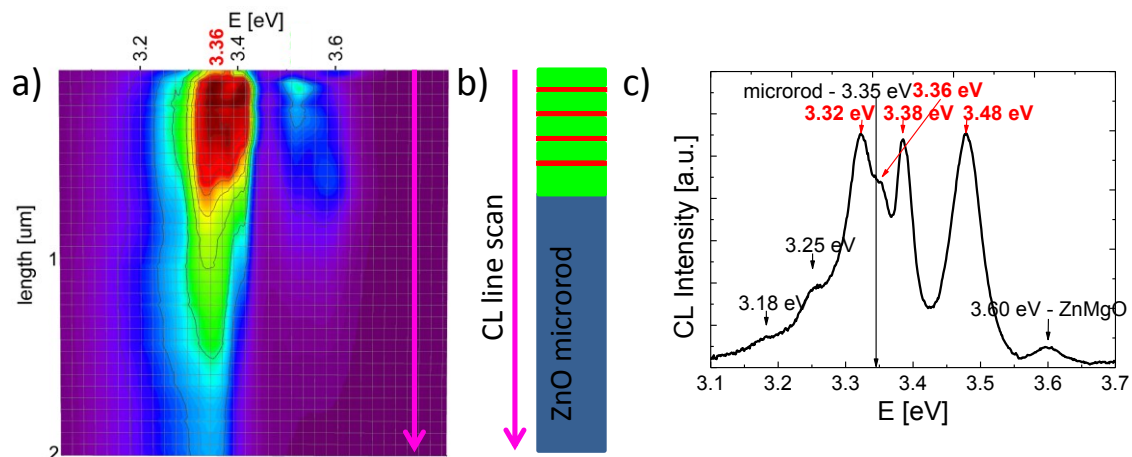


Fig. 1 (a) CL line scan taken along the individual microrod MQW structure from the top to the bottom. (b) Orientation of the CL line scan with respect to the structure marked by arrow at the scheme of the axial ZnO/ZnMgO MQW heterostructure. (c) CL spectrum taken from the upper part of microrod heterostructure. The main spectral features are indicated by arrows.