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Abstract (EN)

During gathering experimental evidences for PhD thesis, thin layers and quantum structures of $ZnO/Zn_{1-x}Mg_xO$ were obtained with PA-MBE (Plasma Assisted Molecular Beam Epitaxy) technique. Establishing of the most optimum growth parameter were realized for two kinds of substrates: *a* plane Al_2O_3 and *c* plane ZnO. Obtaining the appropriate growth conditions for both types of substrates allowed for evaporating of optically pumped laser structures. Both thin layers and quantum structures were characterized by following means: atomic force microscopy (AFM), photoluminescence (PL), X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM). Additionally some of the obtained laser structures were plasma etched in order to obtain Fabry-Perot resonators on them. This made possible achieving optically pumped lasering. All conducted experimentation preceded by a theoretical calculation for investigated structures proofed that detected emission was in fact a lasering. This also allowed for explanation of observed abnormal laser modes separation.

Thesis contains detailed analysis of the most vital growth parameters which are governing the Mg content in the $Zn_{1-x}Mg_xO$ alloys of good crystal quality. Those are:

- Magnesium, zinc and oxygen fluxes ratio.
- Substrate temperature.
- Flux and power of the oxygen plasma.

The influence of the substrate holder stage rotation during the growth on the Mg composition homogeneity in the alloys also was the issue investigated in the experimental part of the PhD thesis. As a result of experimentation, the innovative, fast method of obtaining layers with different Mg content during growth process was proposed, which is a subject of patenting process (patent application no: **P.423624**).

Additional subject of investigation undertaken in this work was influence of the hydrostatic pressure on the exciton-phonon interaction in the $ZnO/Zn_{1-x}Mg_xO$ quantum structures.

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