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GROWTH AND SPECTROSCOPY OF $Er_{0.01}$:$KGd_{0.2}Yb_{0.15}Y_{0.64}(WO_4)_2$ EPITAXIAL LAYER

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We determined the best composition of $KGd_xYb_yY_{1-x-y}(WO_4)_2$ layer to be grown on $KY(WO_4)_2$ substrate that exhibit appropriate lattice mismatch and refractive index contrast for optical waveguiding. The Liquid Phase Epitaxial technique was used to grow $Er_{0.01}$:$KGd_{0.2}Yb_{0.15}Y_{0.64}(WO_4)_2$ epitaxial layers on b-oriented $KY(WO_4)_2$ substrate with $K_2W_2O_7$ as a solvent. The synthesis was peformed in an electrical resistance furnace. The growth was carried out at 900–920 °C temperature. The substrate spin rate was 30–40 rpm. We obtained high quality crack-free 180 μm thick Er-doped layer. The resulting sample was cut along N_g optical axis. The length of the layer along N_g axis was 9 mm.

The absorption spectra of the layer was measured at room temperature in the direction perpendicular to the plane of the layer. The results are demonstrated in Fig. 1. The spectra are in a good agreement with the spectra of Er:$KY(WO_4)_2$ bulk crystal. By comparing the measured spectra with known spectra of bulk crystal the Er^{3+} ions content was estimated to be 1.4 at. %.

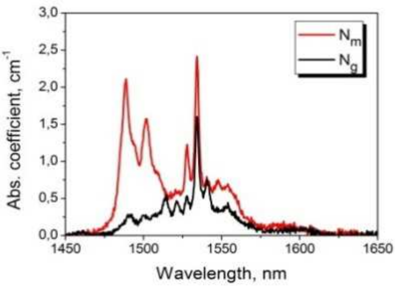

Fig. 1 – Polarized absorption spectra

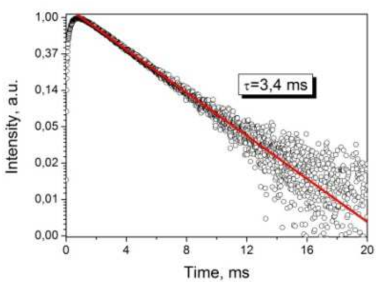

Fig. 2 – Fluorescence dynamic

The fluorescence decay curves of the layer were measured at 1570 nm with excitation by 20 ns pulses at 975 nm wavelength to the absorption band of Yb^{3+} ions. The measured curve was excellently fitted by exponential decay function

(Fig. 2). The estimated lifetime of $^4I_{13/2}$ energy level of Er^{3+} ions in the layer is 3. 4 ms, that is well agree with the lifetime in Er (0.5 at. %):$KY(WO_4)_2$ bulk crystal. Thus, the manufactured epitaxial layers should be used as active media in planar waveguide lasers emitting at 1.5–1.6 μm.

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FEATURES OF ABERRATIONAL ANALYSIS OF ELLIPSOIDAL REFLECTORS TO OPTICAL BIOMEDICAL DIAGNOSTIC

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To optimize the capability of non-imaging optics, including transmission properties, necessary to develop the quality criteria for evaluating of its work, depending on the chosen configuration. Given the structure of photometers with ellipsoidal reflectors (ER) [1] typical quality criteria cannot be used. Therefore, allowing for the light transfer in ellipsoid of revolution with internal mirror surface, is presented result of aberrational analysis based on ray tracing. This will find the optimal solution of many problems in applied optics of light scattering in biological media (BM) by photometer with ER. Using mathematical basis [1, 2] analyzed the process of defining the optimum parameters of ER for its application in experimental photometric system for determining the optical properties of BM. In terms of biophotonics, it due to the need to register the maximum-possible amount of forward and backscattered light. Therefore, correct selection of ER parameters such as eccentricity and diameter of the working window based on the projected numerical experiment within the spatial distribution of scattered radiation from position of aberrational quality is very important. The modeling was made on variable values of focal parameter and eccentricity from the initial point A (2, 0). During the simulation was calculated Centroid (Fig. 1) and RMS (Fig. 2) for total and first reflection on X-axis.

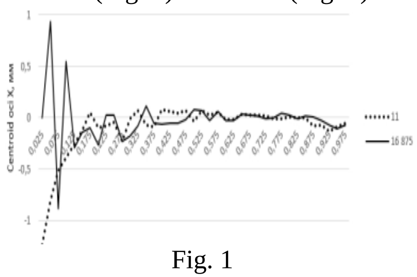

Fig. 1

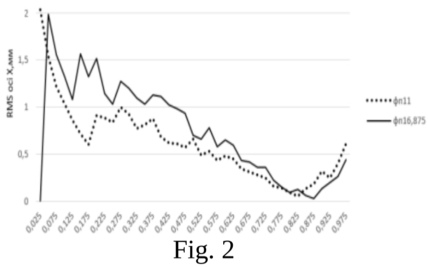

Fig. 2