OBTAINING AND OPTICAL-LUMINESCENT PROPERTIES OF RARE-EARTH ORTHOVANADATE SINGLE CRYSTALS

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Yttrium, gadolinium and lutetium orthovanadates, activated with Eu^{3+}, Nd^{3+}, Yb^{3+} and Tm^{3+}, are good known luminophors and materials for laser elements since the middle of XX century. V^{5+}cations are optical inactive, and rare-earth oxides $REVO_4$ (were RE is trivalent rare-earth elements) are transparent in optical band. Therefore, these matrices can be considered as promising hosts for scintillation materials activated with rare-earth elements.

It's known, that solid state synthesis of rare-earth vanadates from starting oxides is carried out rather easy – 80% of orthovanadates formed at 600^{o}C for 6h, and full reaction between the oxides takes place in the temperature range 700 – 900^{o}C for 5 min [1]. However, difficulties of obtaining transparent rare-earth orthovanadates crystals with of good optical quality are connected with uncontrolled evaporation of V_2O_5 from the melt in inert atmosphere, and unstable valence of vanadium leading to formation of oxygen vacancies in crystals. Evaporation of V_2O_5 is more intensive for $LuVO_4$:RE than for $GdVO_4$:RE and YVO_4:RE[2].

Oxygen vacancies formed during growth of crystals can be compensated with long-term annealing in air or in pure oxygen atmosphere.

In present work we have investigated optimal conditions of synthesis, crystal growth and annealing of orthovanadate ($LuVO_4$, $GdVO_4$ and YVO_4) crystals activated with different rare-earth cations. Optical-luminescent properties of obtained crystals in different regimes of growth and annealing are studied and discussed as well.

References

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