Crystal growth and optical properties of functional Tb^{3+}-doped orthoborates

Kokh AE[1*], Kononova NG[1], Kuznetsov AB[1], Kokh KA[1], Shevchenko VS[1], Simonova EA[1], Svetlichnyi VA[2]
*lead presenter: a.e.kokh@gmail.com
[1]Institute of geology and mineralogy, Russia
[2]Tomsk State University, Russia

In the last decades Tb-doped orthoborates have been studied as promising green phosphors [1], related to high possible concentrations of REE and low concentration quenching. These compounds are perspective as laser medium materials [2]. A direct laser generation with 540 nm wavelength is a simpler scheme relative vs conversion of an ~1μm IR laser on a nonlinear optical crystal to the visible region. Among these crystals there are $(Tb,Sc)BO_3$ solid solutions and orthoborates with general formula $RX_3(BO_3)_4$, in which R = Y,Ln; X = Al,Ga,Cr,Fe,Sc. In addition, magneto-optic properties have been registeredon these crystals doped with terbium [3]. It should be noted that in the $TbX_3(BO_3)_4$ series all compounds with huntite structure ($CaMg_3(CO_3)_4$, space group *R*32) were obtained for X=Al,Ga,Fe,Cr. There is no such structure for X=Sc because of scandium radius beingmaximal in the X series [4].

Analysis of the literature data reveals a fundamental gap in the studies of this class of borate systems. It consists in the fact that the width of the homogeneous region is unknown for the most of compounds. This information is of critical importance because the deviation of the stoichiometry leads to redistribution in cationic positions, as well as the appearance of defects in the crystal lattice. All thesefactors have a major impact on the physical properties of materials. It is thefragmentedinformation about the nature of solid solutions and the crystal chemical features of the distribution of dopants that leads to inconsistency in data on the stability of structural types and physical properties of borates.

In this work new data were obtained on the dependence between the chemical composition, crystal structure and the optical properties of the terbium-doped orthoborates. Phase diagrams including the compounds homogeneity areas, their structural parameters andcomparison of optical characteristics have been refined.

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References
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