LUMINESCENCE OF DOPED WITH Cr, Ti AND Mn IONS ABP_2O_7 PHOSPHATES

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Both of new recently obtained data about luminescence characteristics of double phosphates which contain $(P_2O_7)^{4-}$ anions, various polyvalence metals and Cr, Ti and Mn transition ions and review of known literature data are presented. Investigated compounds are stable, chemically and thermally inert host matrixes. Some of them are promising laser materials, other ones are perspective solid solution materials for engineering new color and white luminophors.

Steady state and time resolved luminescence spectra were obtained in the spectral region 50 – 1100 nm and 4.2 - 300 K temperatures using visible, ultraviolet and vacuum ultraviolet radiation for excitation of luminescence. Experiments with synchrotron radiation were performed at SUPERLUMI station of HASYLAB laboratory at synchrotron in Hamburg, Germany.

Experimental results are comparing with data of electronic structure calculations of some alkali and three charged metals double phosphates.

Dependences of the structure, peak positions and intensity of luminescence on the composition, content of the crystalline water, samples temperature and excitation wavelengths were obtained. The details of the luminescence and excitation spectral bands are considered as caused by intrinsic transitions in transition ions, self trapped excitons decomposition and emission of defect centers and their interaction too.

Large attention is paid to the analysis of the properties of intrinsic luminescence of investigated compounds and the contribution of various types of F- centers into luminescence of different materials is shown.

The peculiarities of the lower ^2E, $^2T_1$ and $^4T_2$ excited states of Cr^{3+} ions are found. and they have been discussed using simple model of configuration coordinate curves. It has been shown that behavior of luminescence characteristics of Cr^{3+} and Ti^{3+} ions are determined by effect of intermediate crystal field. This result in manifestation of distinctive Fano – antiresonance features in the excitation spectra of luminescence, in the ratio of R – lines intensity and intensity of broad band's emission related with $^4T_2 \rightarrow {}^4A_2$ radiation transitions; in compose vibronic structure of these bands and specific dependences of the shape and intensity of $^4T_2 \rightarrow {}^4A_2$ bands on temperature. Some of the mentioned above peculiarities are discussed using simple model of configuration coordinate curves.

Interesting comparison between properties of investigated phosphate compounds and luminescence both of un-doped sapphire single crystals and Al_2O_3 compounds which used as starting materials for single crystal growth has been made.