# LUMINESCENCE SPECTROSCOPY OF $Rb_2KTiOF_5$ OXYFLUORIDE CRYSTALS

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Interest in single crystal $Rb_2KTiOF_5$ is due to many factors: the strong distortion of metal-(O,F) polyhedra in crystal lattice because of different ionicity of metal-O and metal- F bonds. Oxyfluorides are closer to oxides in terms of chemical stability and exhibit physical properties characteristic of both oxides and fluorides. And this single crystal attracts our attention since its structural feature is similar to that of $KTiOPO_4$, a very important nonlinear optical material. In both crystals, the titanium ions are in the octahedral environment with the acentric arrangements.

The aim of this research is the detailed study of luminescence-optical properties of crystals $Rb_2KTiOF_5$, physical interpretation of the received experimental data. The applied aspect of our research is the usage of luminescence control methods for perfect crystal growth process optimization.

Crystals were grown in Institute of Geology and Mineralogy SB RAS (Novosibirsk), the procedure of grown the samples was describe in Ref. [1]. The crystals of room–temperature modification $Rb_2KTiOF_5$ are cubic, space group F$m3m$, Z = 4, with complete anion disorder. The samples were certified using IR, Raman, NMR, chemical analysis and photoelectron spectroscopy methods [1].

Spectra of photoluminescence (PL) and X-ray excited luminescence (XRL) in region of 1.5-5.5 eV, PL excitation spectra using synchrotron radiation (3–22 eV), time-resolved impulse cathode-luminescence (ICL) spectra, the temperature depending of the XRL, decay kinetics as well as thermoluminescence curves were measured.

Some of the main results of the research are presented in Fig. 1. Single crystals $Rb_2KTiOF_5$ are transparent from microwave to near UV range. Spectra PL, XRL, ICL contain only one wide nonelementary band in the region of 2.2 eV with great (~2 eV) Stokes shift. Emission is excited only in the region of long-wavelength fundamental absorption edge, selective bands in the region of crystal transparency are absent. Decay kinetics is monoexponential with the time constant ~20 μs at T=295 K. When cooled to T= 8 K PL intensity increases in ~ 15 times with activation energy of 54 meV.

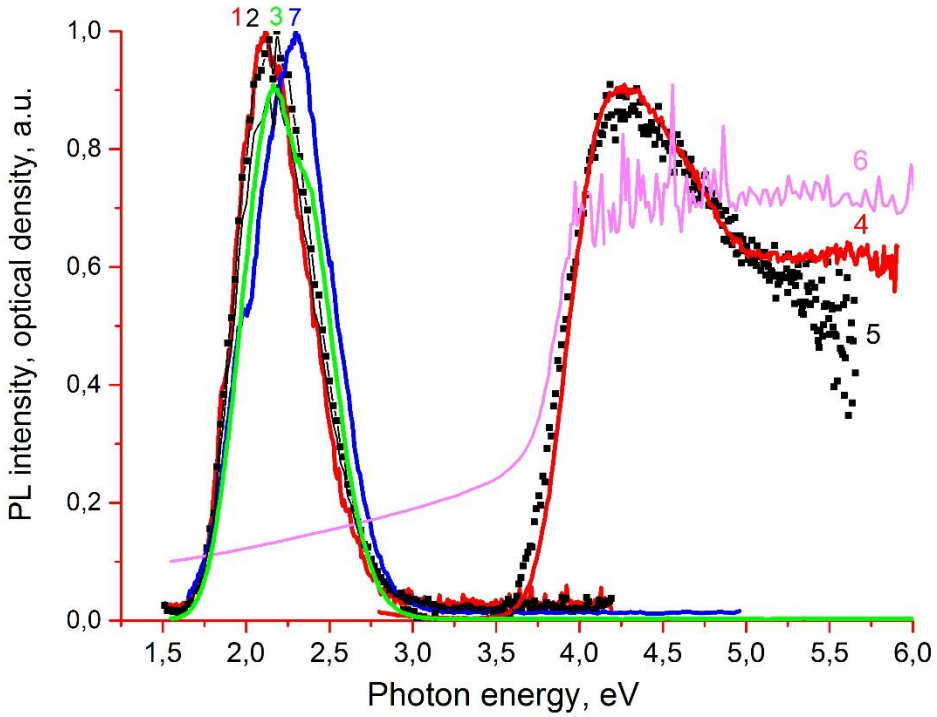


Figure 1. PL (1, 2, 3), PL excitation (4, 5), absorption (6), XRL (7) spectra of $Rb_2KTiOF_5$ single crystals at T=7.6 (3), 90 (1, 4, 7) and 295 K (2, 5, 6). $E_{exc}$=4.5 (1, 2) and 6.9 eV (3), $E_{emis}$=2.2 eV (4, 5).

All the obtained results indicate that nonelementary band 2.2 eV in luminescence spectra is intrinsic and it corresponded to the emission of self-trapped excitons. Non-elementary shape of this band associated with the presence local distortion in $TiOF_5$ octahedron.

Luminescence methods of quality control of grown crystals are proposed.

1. Atuchin V., Isaenko L. et al., J. Phys. Chem., C 117, 7269 (2013).