The Zr-containing phosphates with general formula $K_2XZr(PO_4)_3$ ($X = Y, RE$) attract much attention due to their potential applications in plasma display panels and mercury-free lamps [1-3]. Since the Bi$^{3+}$ and RE ions have close ionic radii, the langbeinite-type $K_2BiZr(PO_4)_3$ crystal can be easily doped with RE ions and therefore can be considered as perspective luminescence material for mentioned applications.

The polycrystalline samples of $K_2BiZr(PO_4)_3$ were synthesized by spontaneous crystallization method. The VUV-excited photoluminescence (PL) properties were studied on SUPERLUMI station at HASYLAB (DESY), Hamburg, Germany in $3.7 – 25$ eV region of excitation energies [4]. Photoluminescence (PL) and PL excitation spectra of the samples were obtained in $4.2 - 300$ K temperature region.

Under excitation with synchrotron radiation, the PL spectra of $K_2BiZr(PO_4)_3$ reveal complex bands with two main components in the UV and visible regions respectively (Fig. 1). These components can be approximated by Gaussians with peak positions at $3.6$ eV and $2.6$ eV respectively. The relative intensities of the components strongly depend on the excitation wavelength.

As Figure 1b shows, the excitation spectra of the UV and visible PL components are substantially different. The visible PL component is most efficiently excited in excitation band peaking at $4.9$ eV. This band is accompanied by a less intensive high-energy band peaking at $5.5$ eV. The UV component is efficiently excited at energies above $6.3$ eV. The main band of its excitation spectrum peaks at $6.8$ eV and a distinctive high-energy shoulder exists in the spectrum in $7.5 – 8.5$ eV region (see Fig. 1b, curves for $\lambda_{\text{reg}} = 300$ and $350$ nm).

A similar excitation band was observed for the UV luminescence of other Zr-containing phosphates [5, 6]. This band was attributed to the O to Zr charge transfer transitions [6]. Excitation bands of the
visible emission component of $K_2BiZr(PO_4)_3$ are typical for excitation spectra of the $Bi^{3+}$-related emission in oxide hosts [7]. So, there is a full reason to assume the bismuth-related origin for the visible emission component of $K_2BiZr(PO_4)_3$ and corresponding excitation bands. Further studies are obviously required to verify these assumptions.

The temperature dependencies of integrated light yields (LY) of the UV and visible components of $K_2BiZr(PO_4)_3$ emission (obtained as areas under corresponding Gaussians) are presented in Figure 2. As the Figure shows, the visible emission band reveals steeper profile of temperature quenching under excitation with photon energy $E_{\text{exc}} = 5.0$ eV ($\lambda_{\text{exc}} = 250$ nm) than in the case of excitation with $E_{\text{exc}} = 6.7$ eV ($\lambda_{\text{exc}} = 180$ nm). Under excitation with $E_{\text{exc}} = 6.7$ eV, the UV and visible PL components reveal no significant difference in temperature profiles of their light yields. Both components are observed at room temperature, however with low intensity. Explanation for obtained LY (T) profiles requires further studies.

![Figure 2: Temperature dependencies of light yields of the visible (a, b) and UV (c) PL components of $K_2BiZr(PO_4)_3$ obtained under $\lambda_{\text{exc}} = 180$ (a, c) and 250 nm (b).](image)

Analysis of the PL emission and excitation spectra allows assuming existence of at least two types of intrinsic emission centres in $K_2BiZr(PO_4)_3$ crystal. One of them which originates emission band peaking at 3.6 eV should be related with ZrO$_6$ polyhedra, while another one (originates emission band at 2.6 eV) is most probably related to Bi$^{3+}$ ions in oxygen coordination.

References