and transmission measurements were carried out over the frequency range from 0 to 5000 cm^{-1} at 4.2 K.

ARPES measurements demonstrated clear Dirac-type dispersion of the surface states with its Dirac point at a binding energy of about $E_B = 230\text{ meV}$. The transmission spectra revealed absorption band edge at 2528 cm^{-1} (suggesting a band gap of $E_g = 0.313\text{ eV}$ at 4.2 K) and free carrier Drude edges at 228 cm^{-1} as well as strong Fabry-Perot oscillations. The reflectivity spectra showed the Drude edge at 256 cm^{-1} and two phonon related features at 51 and 151 cm^{-1} . The asymmetric shape of phonon related features at 51 cm^{-1} suggest its relation to electron-phonon coupling and Fano physics. The middle point of the Drude edge in the reflectivity spectrum corresponds to the minimum in the transmission at 225 cm^{-1} .

The observed peculiarities demonstrate the intrinsic complexity of the studied material. Further investigation of topological effects requires the application of magneto-optical spectroscopy methods.

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LUMINESCENCE STUDY OF KLuP_2O_7 DOPED WITH Pr^{3+} IONS UNDER DIFFERENT TYPES OF EXCITATION

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This paper reports the spectroscopic properties of praseodymium-doped potassium lutetium double phosphates, $\text{KLuP}_2\text{O}_7:\text{Pr}^{3+}(1\%)$. Spectra of photoluminescence (PL), PL excitation, X-ray excited luminescence and pulse cathodoluminescence, thermally stimulated luminescence were measured.

Praseodymium-ions doped luminescent materials are recently being actively investigated due to demonstration of fast interconfigurational $5d - 4f$ optical transitions. The application of such materials is rather perspective in medical and detectors fields. Many detecting materials are doped with Ce^{3+} ions. Praseodymium emission in comparison with cerium ions is located in higher energy region and is characterized with shorter lifetime (about 20 instead of 30 ns). The search of new scintillating materials is very actual problem of modern investigation researches. The study of KLuP_2O_7 doped with Pr^{3+} began in works [1, 2].

Results of spectroscopic properties investigation are presented in this paper. The complex of spectroscopic methods was applied. Measurements of objects were done applying different techniques. Spectra of photoluminescence (PL) upon UV-VUV excitation, PL excitation spectra as well as spectra of X-ray excited luminescence (XRL)

were studied at the Laboratory of Solid State Physics, Ural Federal University. The X-ray excited studies were performed at the same laboratory included measurements of thermally stimulated luminescence (TSL) glow curves. The measurements of decay kinetics and emission spectra upon excitation with non-monochromatic X-ray synchrotron radiation were performed at the beamline #6 of the VEPP-3 storage ring at Budker Institute of Nuclear Physics (Russia). To detect the XRL a stroboscopic method of electron-optical chronography with sub-nanosecond time resolution was used. The pulse cathodoluminescence (PCL) spectra and PCL decay kinetics were recorded at University of Tartu (Estonia). Each spectrum was calculated according to spectral sensitivity of detecting system.

Study of X-ray excited luminescence exhibits wide bands in UV region (270-310 nm) with nanosecond decay time connected with interconfigurational $4f15d \rightarrow 4f2$ radiation transitions with different Stokes shift (Fig. 1, left side). These transitions are considered to be the emission from the lowest $4f15d$ excited state of the Pr^{3+} ion to the multiplets of ground states of the $4f2$ configuration. A set of wide emission bands in region of $\sim 400 - 450$ nm considered to be defect-related luminescence can be observed.

The pulse cathode luminescence decay kinetics measurements are presented in Fig. 1, right side. The PCL decay curves demonstrate two-exponential behavior with lifetime of fast component $\tau = 20$ ns, slow component $\tau = 70$ ns. Due to this, the two-exponential approximation was applied to these spectra. The contribution of slow μ_s – component amounts $10^{-3} - 10^{-4}$.

Fig. 1. Left: XRL spectra of $\text{KLuP}_2\text{O}_7:\text{Pr}^{3+}$ (1%), $T = 295$ K (red), $T = 105$ K (black), temperature dependence of XRL 260 nm peak line (blue). Right: PCL decay kinetics recorded monitoring $4f15d \rightarrow 4f2$ emission of $\text{KLuP}_2\text{O}_7:\text{Pr}^{3+}$ and defect-related luminescence excited with X-ray radiation. $T = 295$ K

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