CPPP 46 P ABSORPTION AND PHOTOLUMINESCENCE IN WULFENIT ($PbMoO_4$) CRYSTALS

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Lead molybdate (PbMoO4) is extensively employed in acousto-optic device applications because it has a high acousto-optic figure of merit, low acoustic and optical loss below 1 GHz and favorable mechanical impedance for acoustic matching. Recently this material is found to be useful as a scintillator for the double β decay experiment below 100 K.

The interest to the study of optical properties of PbMoO4 crystals is determined not only by fundamental physical mechanism present in this material, but also by a wide spectrum of possible applications in high speed acousto-optic devices : intensity modulators, acousto-optic deflectors and tunable filters, power spectra analyzer, ion conductors, etc.

The phenomena usually studied to obtain information on the optical properties of crystals are absorption and photoluminescence in the large wavelength range. In this work were used $PbMoO_4$ crystals that belong to the space - symmetric group 4/m obtained through extraction from melt according to Chochralsky method mainly to [100] direction having the lattice parameters a=5.4312Å and c=12.1Å, light yellow color, crystal type group –tetragonal, negative uni-axial. The optical properties were analysed by ultraviolet-visible (UV-Vis) absorption and photoluminescence (PL) measurement. A description of experimental results of studying the optical absorption and photoluminescence (PL) of tetragonal (class 4/m) $PbMoO_4$ crystals is given.

The measurements of light transmitted and reflected in the polarized radiation for both orientation (**E** || $\mathbf{C_4}$ and **E** ⊥ $\mathbf{C_4}$**),** where $\mathbf{C_4}$ is the optical axis of crystal corresponding to the crystallographic [001] direction at 300 and 77 K , were made.

Optical studies revealed the fundamental absorption in a VIS range at $\lambda > 0{,}3$ μm what corresponding inter-band transition of crystals [1]. The measured spectral dependence of the absorption coefficient at two orientation of polarization of light and the known theoretical dependence were combined and compared for determination the types of optical transitions in fundamental absorption of $PbMoO_4$ crystals. Spectral dependence of the absorption coefficient at the edge absorption ($\lambda \approx 0{,}3$ -0,5 μm) shows that the edge absorption is determined by indirect assisted by phonons transitions. Limited energies E_g^{ind} and E_g^{dir} for **E**|| $\mathbf{C_4}$ and **E** ⊥ $\mathbf{C_4}$ were founded.The inter band (direct and indirect) transition minima at 300 and 77 K is determined and temperature dependence of the absorption edge shift are studied. Possibilities of the interpretation of particularity of absorption spectra on the basis of the proposed band structure are examined. The direct optical edges E_g at T = 300 K are 3.28 eV and 3.36 eV for **E** || $\mathbf{C_4}$ and **E** ⊥ $\mathbf{C_4}$ respectively. The indirect gaps are 3.08 eV and 3.16 eV respectively. The temperature coefficient of shift of E_g^{ind} is $1.8.10^{-4}$ eV/deg. It is presented a detailed investigation of the fundamental absorption of $PbMoO_4$ crystals. The simple model of band structure of crystals was proposed. Photoluminescence (PL) of wulfenite ($PbMoO_4$) measurements were performed at room temperature on as differing size crystals. The PL was excited by 365 nm (E_{ex}=3.39 eV, Hg triplet 6^3P_2-6^3D_3) photons of an focused super-high-pressure Hg lamp beam and detected by a photomultiplier FEU-38through a grating monochromator using the look-in technique. An intense blue-green PL band emission was observed.

All these spectra are Stokes shifted and can be characterized with large band half-width and solely by Eg gap. AS shown in [2] the origin of the PL emissions as well as its intensity variations are may be explained by means of a model based on both distorted [MoO4] and [PbO8] clusters into the lattice. When the absorbtion spectra are compared with the corresponding photoluminescence of crystals, red shift in their photoluminescence peaks, wider optical band gaps are observed.

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