THE INFLUENCE OF UNIAXIAL PRESSURE ON BIREFRINGENCE Rb_2ZnCl_4 CRYSTALS

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Crystals of Rb_2ZnCl_4 (TCZR) belong to the known type of ferroelectrics with incommensurate phase (ICP). They undergo two successive phase transitions (PT): the second-order at T_i = 302 K from the paraphase (space group *Pnam*) to ICP with wave vector $q = (\frac{1}{3} - \delta) \cdot c^*$, and the first-order at 192 K from ICP to the improper ferroelectric commensurate phase (CP) (space group Pna_12) with spontaneous polarization P_s arising in X-direction $\vec{P}_c \| \vec{a}$. The optical investigations of TCZR crystal (i.e. temperature and spectral changes of refractive indices and birefringence, temperature dependences of combined piezooptic coefficients) have shown anomalies at PT's.

The purpose of the present work is an investigation of the influence of uniaxial mechanical pressure acting in X, Y, Z-crystallophysical directions and in the bisectors between them upon spectral and temperature changes of refractive indices n_i of TCZR crystals for light spreading in X, Y, Z- directions.

It was established that, in the spectral range 300–800 nm, the dispersion of the refractive indices n_i of TCZR is normal and can be well described by the two-term Sellmeier formula

$$n^2 = 1 + \frac{B_1 \lambda^2 \lambda_{01}^2}{\lambda^2 - \lambda_{01}^2} + \frac{B_2 \lambda^2 \lambda_{02}^2}{\lambda^2 - \lambda_{02}^2}. \quad (1)$$

Using relation (2), the parameters λ_{01}, λ_{02}, B_1 and B_2 of the two-term Sellmeier formula were determined. Comparison of the refractive parameters of Rb_2ZnCl_4 and K_2ZnCl_4 crystals showed the following. The replacement $Rb^+ \rightarrow K^+$ does lead to substantial changes in n_i (an increase amounts to $7–12\times10^{-3}$), with the centers of gravity of UV oscillators being shifted toward shorter ($\Delta\lambda_{0i} \sim 3–5$ nm) wavelengths. The shift λ_{01i} is accompanied by different changes in the strength of effective UV oscillators.

The baric variations of the refractive indices $n_i(\lambda, T)$ were calculated, making use of the known temperature and spectral dependences of the absolute piezooptic coefficients π_{im} and the refractive indices n_i of a mechanically free crystal, by the relationship

$$n_i(\lambda, T) = n_{io}(\lambda, T) - \frac{1}{2} p_{im}(\lambda, T) y_m n_{io}^3(\lambda, T) \quad (2)$$

It was shown that uniaxial stresses along various crystallophysical axes were found to be responsible increase of the refractive indices Δn_i different by amplitude. The increase of absolute refractive indices n_i is caused by the decrement of the effective strength of UV oscillators and by the displacement of the effective center of UV absorption band to the longwave region. Higher sensibility of the dependences $n_i(T)$ to the stress effect was observed in the region of ICP. It is caused, to our mind by the peculiarities of the interaction between the modulated structure and the uniaxial deformation.