Temperature Depence of Refractive Indices in selected Borates

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The knowledge of the temperature dependence of the refractive indices of a nonlinear optical crystal play a key role for its classification as a NLO material. For example, the temperature dependence can be used as a possibility for fine tuning of the phase-matching conditions of a nonlinear optical frequency conversion process. In general it is advantageous to describe the temperature dependence of the refractive indices using the temperature dependence of the polarisation tensor $[a_{ij}]$ (optical dielectric impermeability tensor) $\Delta a_{ij} = b_{ij}\,\Delta T + c_{ij}\,\Delta T^2 + \ldots$, where $[b_{ij}]$, $[c_{ij}]$,.. describe the linear, quadratic, etc. temperature dependence of the polarisation tensor. In most cases (far from phase transitions) the linear approximation turn out to be an adequate description.

In this work we present a technique for the measurement of temperature dependence of refractive indices based on a Jamin interferometer, which allows to measure optical path length differences as a function of temperature (temperature range: 50…280 K). The knowledge of the refractive indices at a reference temperature T_o (e.g. room temperature) including the orientation of the indicatrix, and the knowledge of thermal expansion data in the same temperature range are necessary for the evaluation of the experimental data.

As results we present the $[b_{ij}]$ tensors of the non-centrosymmetric borate crystals: $Zn_4[O(BO_2)_6]$ (PG: $\bar{4}3m$), $Li_2B_4O_7$ (PG: *4mm*), β-BaB_2O_4 (PG: *3m*), PbB_4O_7 (PG: *mm2*), SrB_4O_7 (PG: *mm2*) and BiB_3O_6 (PG: *2*).

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