2.5 Pulsed Photoexcitation Studies in Photorefractive $KNbO_3$ at Ultraviolet Wavelengths

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The nanosecond photorefractive response in nominally pure $KNbO_3$ to pulsed uv (λ = 354.7 nm) illumination was studied at a grating spacing of 0.4 µm for different grating orientations and for different beam polarizations over a range of writing energy densities. Because the excitation pulses are absorbed ($a \approx 1500$ cm[1]) the grating has a thickness of about 10 µm. In order to have appreciable interaction lengths between the grating and the read-out pulses (λ = 532 nm) a transversal geometry was implemented. In a set-up of this type the writing pulses impinge upon the sample from above and the read-out pulses read out the grating from the side. The two interfering writing beams overlap spatially and temporally. A delay line allows the arrival time of the read-out pulses to be varied with respect to the writing pulses.

In general the photorefractive response observed on a nanosecond time scale is steplike with contributions due to four wave mixing at delays where all three pulses are in the crystal simultaneously. For a grating oriented along the *c*-axis the diffraction efficiency at delays larger than one nanosecond rises linearly with the writing energy density. When the grating is oriented along the *a*-axis, in which case no electro-optic contributions to the diffraction efficiency are possible, the writing energy density dependence of the diffraction efficiency is quadratic at small writing energies and shows a linear behaviour at higher energies. The diffraction efficiency due to a grating along *c* is generally around ten times stronger than the response due to a grating along *a*. In addition a strong dependence upon the polarizations of the pulses involved is observed.

A definite understanding of the effects measured is not possible yet. However, explanations of the photorefractive behaviour in terms of interband excitation of charges forming the Sellmeier oscillators are being considered.