o.m1.p7 **Holographic measurements as a probe for domain dynamics and polarization reversal in the ferroelectric relaxor Strontium-Barium-Niobate**. U. Dörfler[1], M. Imlau[1], Th. Woike[1], W. Kleemann[2], R. Pankrath[3], M. Wöhlecke[3], [1] *Institut für Kristallographie, Universität zu Köln,* [2] *Angewandte Physik, Universität Duisburg,* [3] *Fachbereich Physik, Universität Osnabrück.*
Keywords: ferro-electricity, NLO materials, holographic data storage.

Holograms written by two beam coupling can be fixed by applying an external electric field E_{ext} in the ferroelectric relaxor Strontium-Barium-Niobate (SBN), $Sr_xBa_{1-x}Nb_2O_6$. This so called electric fixation is of great interest for technical applications, e.g. holographic data storage.

Interference of two plane waves on the crystal causes a periodically modulated light intensity distribution. Excitation of electrons in the illuminated regions and trapping in the dark regions results in a separation of the charge carriers. A periodically modulated internal space charge field E_{sc}, which is proportional to the light intensity modulation m, builds up. This field causes a spatial modulation of the refractive index via the linear electrooptic effect. Homogeneous illumination during the reading process redistributes the electrons and erases the hologram. It is assumed that the electric fixation process works by compensating the charge carrier distribution by modulating the orientation of the ferroelectric domains in the material. This is realized by applying an external electric field E_{ext}. This external field and the periodically modulated internal space charge field are superposed. As a result, the homogeneous electric polarization P_3 is only reversed in areas of the crystal where the sum $E_{ext}+E_{sc}$ exceeds the coercive field. To obtain a physical understanding of the fixation process, the dynamics of the polarization reversal are studied holographically.

The two beam coupling gain Γ is directly proportional to P_3. This allows a measurement of domain dynamics using holographic methods. Due to the large linear electrooptic coefficients (r_{13}=56pm/V, r_{33}=333pm/V, r_{42}=38pm/V for SBN with x=0.61 doped with 0.66mol% Ce), high values of Γ in the range of 40cm^{-1} are reached for λ=632,8nm.

We show the influence of E_{sc} on P_3 by variation of the modulation m of the light intensity. Resulting from dynamic measurements, the variation of the polarization in time is non-exponential.

To examine 180°-domains specifically, they are produced by light induced domain switching and visualized by two beam coupling topography. We present the intensity dependence of the light induced domain switching and the connection to the electric fixation of holograms.

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o.m1.p8 **Influence of impurities on the second harmonic generation efficiency in $KTiOPO_4$ crystals.** M. Imlau[1], K. Betzler[1], E. Krätzig[1], Th. Woike[2], [1]*Fachbereich Physik, Barbarastr. 7, Universität Osnabrück,* [2]*Institut für Kristallographie, Zülpicherstr. 49b, Universität zu Köln, GERMANY*
Keywords: ferro-electricity, NLO materials.

Non centrosymmetric $KTiOPO_4$ (KTP) is an efficient material for intra-cavity second harmonic generation (SHG) and, therefore, of technological interest, e.g., for the construction of integrated Nd:YAG laser systems. However, the intensity of the frequency-doubled wave decreases in some KTP crystals with simultaneous exposure to λ = 1064 nm and λ = 532 nm after some hundred hours due to an increase of the extinction coefficient. This „grey tracking effect“ is accompanied by short breakdowns of the output laser intensity with a duration of a few milliseconds. This laser spiking can be suppressed by detuning the laser cavitiy, which consequently reduces the output laser power. Therefore, the detuning or even an exchange of the KTP crystal is undesirable with respect to the technological point of view.

The physical fundamentals of both effects are still under investigation. First measurements show that the crystal growth technique is important for the grey tracking effect. The extinction coefficient ε was measured during illumination with λ = 1064 nm. Regular flux-grown KTP crystals show the largest increase of the extinction coefficient up to ε=5·10^{-4} cm^{-1}, whereas hydrothermally grown crystals reach saturation at about ε=2·10^{-4} cm^{-1}. The best results are achieved by a modified flux-growth technique, so that it seems that the purity of the crystal is decisive for the grey tracking effect. We therefore analyzed the concentration of impurities in different KTP crystals with instrumental neutron activation analysis (INAA). As a result, we found 40 ppm chromium in regular flux-grown KTP and 0.8 ppm in modifed flux-grown KTP. It is well known that an impurity level of 40 ppm is sufficient to cause a photorefractive behaviour, which may result in refraction or diffraction of the transmitted laser beam. This process is accompanied by an increase of the extinction coefficient and the build-up of stray-light. Therefore, we investigated intra-cavity the temporal dynamic of the stray light, which originates from e.g. holographically written phase gratings. The dynamical behaviour of the extinction coefficient is investigated at different wavelengths to get information about the dispersion behaviour of the extinction effect.

The grey tracking effect can also be explained by the existence of small polarons in KTP crystals as observed in $LiNbO_3$:Fe. Charges are excited into the conduction band with λ = 532 nm and are redistributed with λ = 1064 nm, which influences the refractive indices and thereby the phase matching condition. Such polarons are characterized by a broad absorption band centered in the infrared spectral range, which may cause an increase of the extinction coefficient down to the visible spectral range. We investigated ε in KTP crystals at different wavelengths after single puls illumination with λ = 1064 nm and after double puls illumination with λ = 532 nm and λ = 1064 nm. [This work was supported by the Deutsche Forschungsgemeinschaft (project TFB13/A3)]