Characterization of domain gratings in KTP and RKTP crystals for second harmonic generation

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Abstract

Lasers are used in a vast range of applications ranging from eye surgery to devices for measuring air pollution. Most of these applications require specific wavelengths that cannot be obtained by regular lasers. Therefore it is important to be able to convert the wavelength of the laser to the desired wavelength for a specific application. This is achieved by using nonlinear optical crystals in which an incoming light frequency can be converted into another.

Due to the material's chromatic dispersion there is a phase mismatch between the incoming and generated light, which prevents a net increase of the generated light's power. A solution to this problem is the creation of domain gratings in ferroelectric crystals, which compensates for the phase mismatch between the interacting photons. However, the conversion efficiency will depend on the quality of the grating.

In this study, we have characterized $KTiOPO_4$ and Rb-doped $KTiOPO_4$ ferroelectric crystals in terms of their efficiency to convert infrared light to blue light. This conversion efficiency has been correlated to the domain structure and the quality of the grating. We have found that the homogeneity of the grating, and the existence of damage on the crystal have a strong impact on the conversion efficiency.

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Construction of a setup for dispersion measurements on multilayer structures

Abstract

This bachelor thesis intends to perform dispersion measurements on multilayer broadband semiconductor samples. This, since they are used in laser experiments including several optical devices. The dispersion of the semiconductor samples is an error source, and by the measurements, the experiments can be more efficient, not to be using trial-and-error.

For these measurements, a Michelson interferometer is used, interfering a beam of white light with itself, using the semiconductor sample as a mirror. The interfering beam is then sent into a detector that displays the intensity as a function of wavelength. This can be saved as data files, which can be analyzed using the Windowed Fourier Transform-method in Matlab, achieving the dispersion characteristics of the samples.