

Paolo Minzioni
Department of Electronic
Cristalli Ferroelettrici per Ottica Non Lineare
Prof. Vittorio Degiorgio

The research activity has been focussed on the study of the optical linear and nonlinear characteristics of lithium niobate (LN) crystals. This crystal is particularly interesting, as it exhibits large optical nonlinear coefficients and electro-optic coefficients, which make it suitable for the realization of ultra-fast optical signal-processing functions. The main problem in the use of this crystal is that it is affected by the photorefractive effect, which produces a change of the LN refractive indices, when the crystal is illuminated by a beam with a sufficiently high photon-energy. In order to solve this problem, one possibility proposed and studied by the group headed by Prof. Degiorgio is that of adding a small percentage of Hafnium (Hf) oxide to the crystal composition¹.

The activity that has been carried out in this field has demonstrated by means of experimental measurements that the photorefractive effect is strongly reduced in presence of Hf in concentration above 2.5 mol%, and the performed analysis have allowed to show some properties of the photorefractive effect, that had never been reported before in the scientific literature for similar crystals^{2,3}.

The crystal characterization is going on using different experimental setup to analyze the different crystal properties and to investigate their behaviour when different intensity ranges of the light beam are used. Thanks to the collaboration with several research centres the research is now aimed at evaluating the possibility to use HF-doped LN crystal for the realization of all-optical frequency converters, with applications in visible light generation devices and in optical communication systems.

References:

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