

Rare-Earth Ions Doped Lithium Niobate Crystals: Luminescence and Raman Spectroscopy

Authors : Ninel Kokanyan, Edvard Kokanyan, Anush Movsesyan, Marc D. Fontana

Abstract : Lithium Niobate (LN) is one of the widely used ferroelectrics having a wide number of applications such as phase-conjugation, holographic storage, frequency doubling, SAW sensors. Furthermore, the possibility of doping with rare-earth ions leads to new laser applications. Ho and Tm dopants seem interesting due to laser emission obtained at around 2 μm . Raman spectroscopy is a powerful spectroscopic technique providing a possibility to obtain a number of information about physicochemical and also optical properties of a given material. Polarized Raman measurements were carried out on Ho and Tm doped LN crystals with excitation wavelengths of 532nm and 785nm. In obtained Raman anti-Stokes spectra, we detect expected modes according to Raman selection rules. In contrast, Raman Stokes spectra are significantly different compared to what is expected by selection rules. Additional forbidden lines are detected. These lines have quite high intensity and are well defined. Moreover, the intensity of mentioned additional lines increases with an increase of Ho or Tm concentrations in the crystal. These additional lines are attributed to emission lines reflecting the photoluminescence spectra of these crystals. It means that in our case we were able to detect, within a very good resolution, in the same Stokes spectrum, the transitions between the electronic states, and the vibrational states as well. The analysis of these data is reported as a function of Ho and Tm content, for different polarizations and wavelengths, of the incident laser beam. Results also highlight additional information about π and σ polarizations of crystals under study.

Keywords : lithium niobate, Raman spectroscopy, luminescence, rare-earth ions doped lithium niobate

Conference Title : ICOP 2019 : International Conference on Optics and Photonics

Conference Location : Sydney, Australia

Conference Dates : May 16-17, 2019