Vibrational Signatures of Ti and Fe Doped Lithium Niobate

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Lithium niobate is one of the foremost studied materials for nonlinear integrated optics. Its large electro-optical and nonlinear coefficients, its availability and the possibility to achieve phase matching via periodic poling makes it an ideal choice for applications. Another key component for integrated optics are waveguides, which are typically fabricated via indiffusion of metal ions in lithium niobate. Here, titanium is one of the most common materials, because it provides low loss waveguides [1], as well as an increase in both, the extraordinary, as well as ordinary refractive index. The performance of lithium niobate devices is often limited by photorefractivity. While the Ti^{4+} ions do not directly increase the photorefractivity, Ti^{4+} does stabilize the Fe^{2+} impurity, which is strongly connected to this effect [2]. Fe^{2+} and Fe^{3+} impurities are almost omnipresent in lithium niobate and are introduced during growth. In this work we study Fe and Ti doped stoichiometric lithium niobate crystals via high resolution, low temperature Raman spectroscopy to gain further inside into the defects and defect complexes. In particular we focus on co-doped samples, because very little is known about the interplay of Fe^{2+} and Ti^{4+} defects. Further insight in these defects may provide a path towards improved of devices.

[1] H. Hu, et. al., Appl. Phys. B, **98**, 677-679 (2010)
[2] V. Gericke, Appl. Phys. B, **44**, 155 (1987)