EPR and ENDOR of Nd$^{3+}$ in congruent and stoichiometric LiNbO$_3$

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Montana State University — Since many years Lithium Niobate (LN) is of great
interest for both fundamental science and applications because of the unusual rich-
ness of its ferro-, pyro- and piezoelectric properties. Conventional LN crystals, grown
from a congruent melt with lithium deficiency, contain some percent of intrinsic de-
fects. Samples grown under special conditions from melts, to which potassium has
been added, have reduced contents of intrinsic defects and lower disorder (stoichio-
metric samples). Both congruent and stoichiometric crystals doped with neodymium
were studied with the help of the electron paramagnetic resonance, EPR. Tremen-
dous narrowing of the EPR lines in stoichiometric samples in comparison with con-
gruent ones allowed us to distinguish four non-equivalent centers, as well as line
splitting caused by hyperfine interaction of neodymium electrons with nuclear spins
of magnetic isotopes $^{143}$Nd and $^{145}$Nd. One of the centers has axial C$_3$ symmetry,
whereas others have lowest C$_1$ symmetry due to presence of intrinsic defects or/and
charge compensation defects in the near neighborhood of Nd$^{3+}$. Narrow EPR lines
allowed us also to investigate Electron Nuclear Double Resonance (ENDOR). Struc-
tures of the Nd$^{3+}$ centers derived from the EPR/ENDOR data and effects produced
by micro- and macro-imperfections of LN crystals are discussed.

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