No. 2B-1 $LiNbO_3$–$HNbO_3$

1b	Phase relation: Fig. 2B-1-001.	
2a	Proton-exchange by sulfuric acid: see	90Car
	Proton-exchange by pyrophosphoric acid: see	89Got, 92Yam, 93Zil
	Proton-exchange in undoped $LiNbO_3$ (dilute melt): see	89Won1
	Proton-exchange in Ti-indiffused and MgO-doped $LiNbO_3$: see	89Hin1
	Proton-exchange in undoped $LiNbO_3$ (concentrated melt): see	89Won2
3a	Unit cell parameters: Fig. 2B-1-002, Fig. 2B-1-003. See also	86Min
b	Crystal structure of proton-exchanged layers on single crystals: see	89Ito
	Crystal structure of proton-exchanged waveguides: see	94Fei
4	Thermal expansion: Fig. 2B-1-004.	
8a	Velocity of SAWs on proton-exchanged $LiNbO_3$: see	89Hin2
	Surface acoustic wave properties on proton-exchanged surface: see	93Kak
9a	Refractive index: Fig. 2B-1-005, Fig. 2B-1-006.	
	Dependence of refractive index on hydrogen concentration in proton-exchanged crystal: see	91How
	Proton-exchange layers and proton diffuse profiles investigated with Fourier-IR: see	92Kap
e	Characteristics of periodically domain-inverted (by proton-exchange) waveguides for second harmonic generation: see	91Yam
	Recovery of optical nonlinearity in annealed proton-exchanged crystals: see	91Cao
	Cerenkov second-harmonic generation in proton-exchanged waveguides: see	90Key
	Proton-exchange layers and proton diffuse profiles investigated by second harmonic generation: see	92Kap
10a	Raman scattering: Fig. 2B-1-007, Fig. 2B-1-008.	
11	Influence of H-D isotropic substitution on the protonic conductivity: see	92Kla
13a	NMR: Fig. 2B-1-009.	
c	Mössbauer study of proton-exchanged crystals: see	90Eng
15b	Domain inversion by proton-exchange and quick heat treatment: see	94Zhu
16	Effect of annealing to $LiNbO_3$:H waveguides: see	91Gan
	Fabrication of periodically inverted domain structures using proton-exchange: see	92Mak
	Proton-exchanged optical waveguides using toluic acid: see	92Loi
	Outdiffusion of protons and deuterons by electron irradiation: see	91Gon
	Proton-exchanged waveguides using octanoic acid: see	92Pun
	Fabrication of proton-exchanged waveguides using stearic acid: see	90Mac
	Proton-exchanged periodically segmented waveguides: see	94Thy

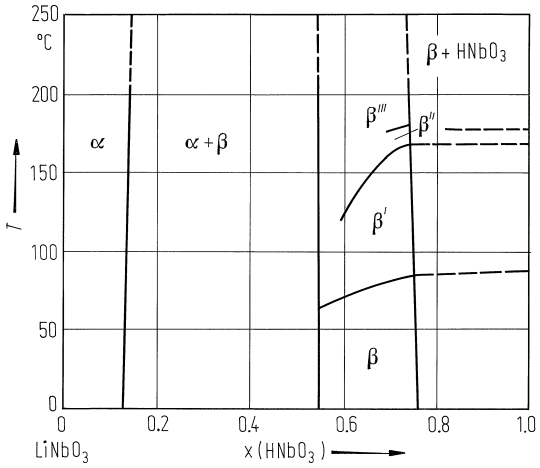

Fig. 2B-1-001. (1−x)$LiNbO_3$·x $HNbO_3$. Approximate phase diagram [86Ric]. β, β', β", β"': four different rhombohedral phases.

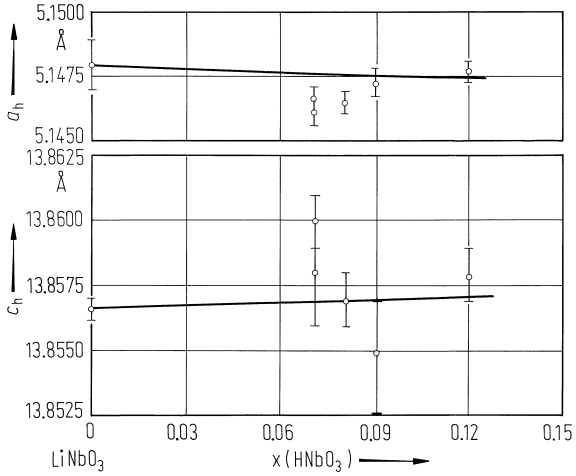

Fig. 2B-1-002. $Li_{1-x}H_xNbO_3$. Unit cell parameters of α-phase vs. x [86Ric]. (Li+H)/Nb = 1 (stoichiometric). h = hexagonal.

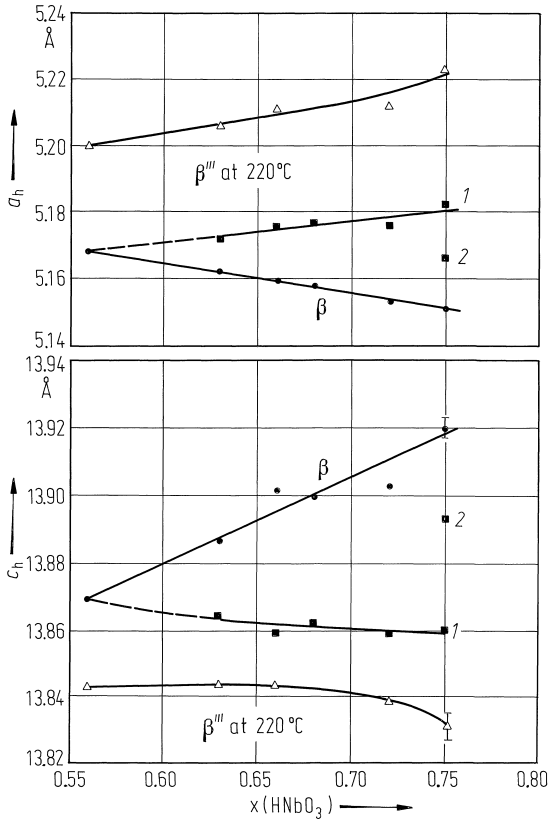

Fig. 2B-1-003. $Li_{1-x}H_xNbO_3$. Unit cell parameters of β-phase vs. x [86Ric]. *1* and *2* show the two metastable forms obtained by quenching a sample from 220 °C to RT. Full circles: sample in equilibrium. (Li+H)/Nb = 1 (stoichiometric).

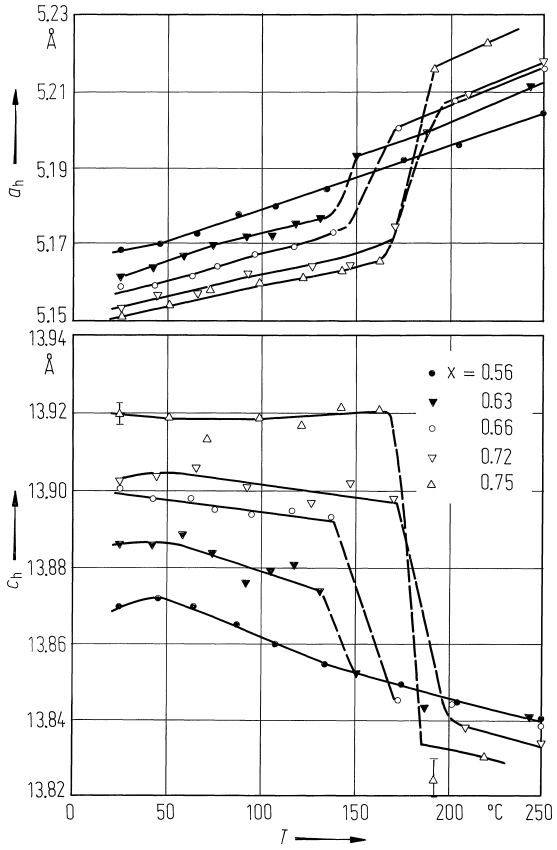

Fig. 2B-1-004. $Li_{1-x}H_xNbO_3$. Unit cell parameters of β-phase vs. *T* [86Ric]. Parameter: x. (Li+H)/Nb = 1 (stoichiometric).

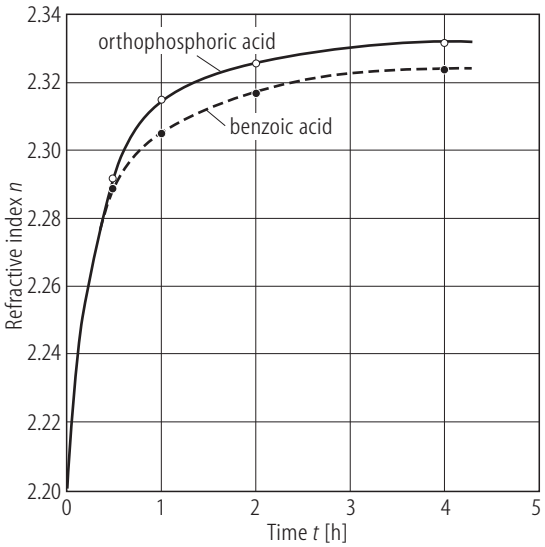

Fig. 2B-1-005. $LiNbO_3$ (proton-exchanged). n vs. t [93Daw]. n: TM_0 light refractive index; t: proton-exchange time.

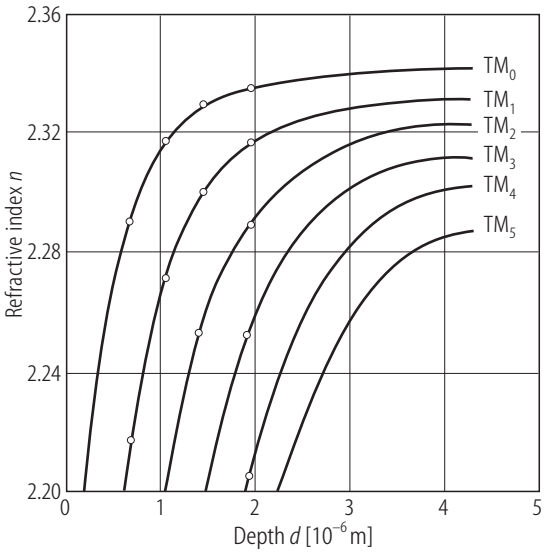

Fig. 2B-1-006. $LiNbO_3$ (proton-exchanged). n vs. d [93Daw]. n: refractive index; d: depth from the surface. Parameter: mode number. Solid lines are theoretical curves.

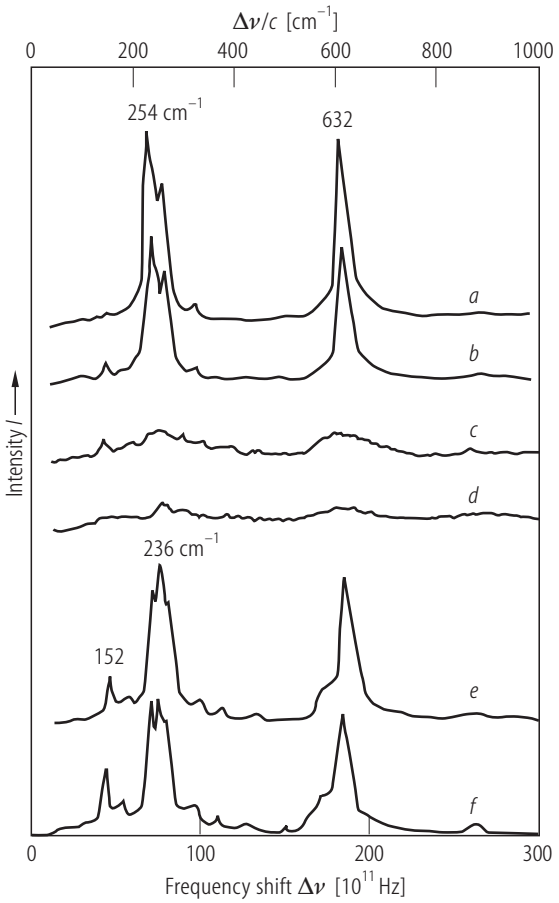

Fig. 2B-1-007. $LiNbO_3:H^+$. Raman scattering: *Y*(*ZZ*)*X* [94WuX]. Curve *a*: pure $LiNbO_3$; *b*: 8 h proton-exchange; *c*: 12 h; *d*: 14 h; *e*: 16 h; *f*: 18 h.

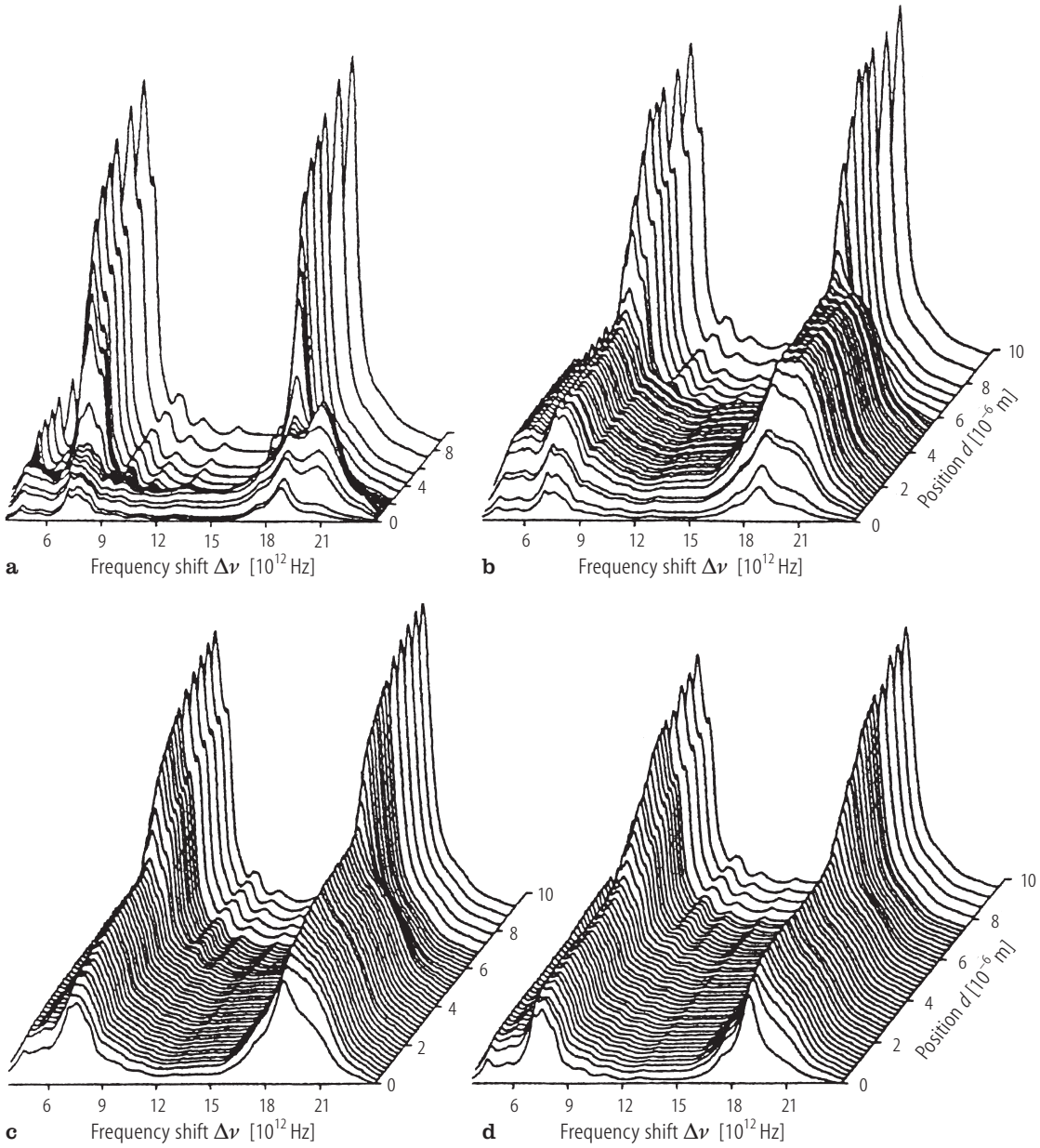

Fig. 2B-1-008. $LiNbO_3$ (proton-exchanged). Micro-Raman images [94Tus]. $\Delta\nu$: Raman shift. Parameter: position from the surface. (**a**) Unannealed; (**b**) annealed for 1 h; (**c**) 4 h; (**d**) 10 h.

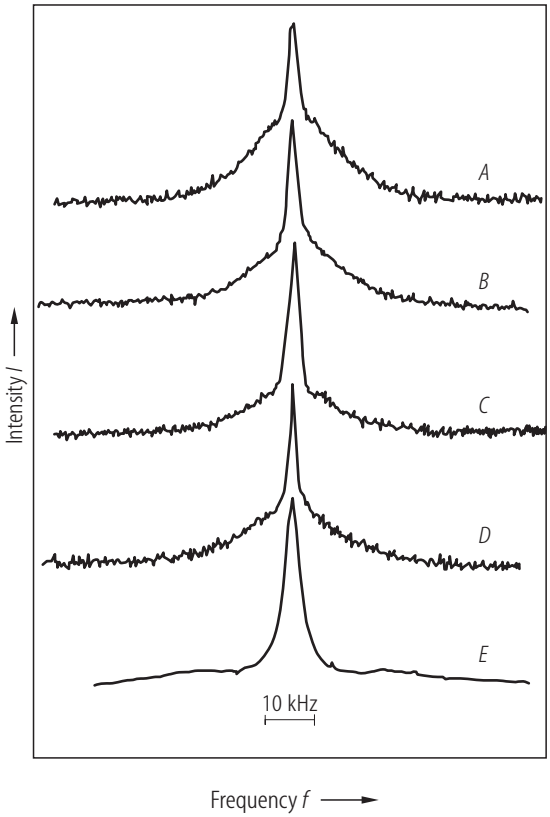

Fig. 2B-1-009. $LiNbO_3$:H. Proton NMR spectra with various proton-exchange (PE) conditions [95DeS]. ν_L = 90 MHz. Curve *A*: Benzoic acid 200 °C, PE time 9 h; *B*: Benzoic acid 200 °C, PE time 18 h; *C*: Phosphoric acid 190 °C, PE time 8 h; *D*: D_2SO_4 containing 3% of H_2SO_4 190 °C, PE time 8 h; *E*: H_2SO_4 190 °C, PE time 2 h.

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