No. 2B-6 $LiNbO_3$–$LiTaO_3$

1b	Ferroelectric transition temperature: Fig. 2B-6-001. Density: $\rho = 7.348 \cdot 10^3$ kg m^{-3} for $LiNb_{0.1}Ta_{0.9}O_3$.	86Wan
2a	Crystal growth: pulling method. Phase diagram: Fig. 2B-6-002, Fig. 2B-6-003. Fabrication of $Li(Nb,Ta)O_3$ films by sol-gel method: see	77Shi1 89Hir
3a	Lattice parameter: Fig. 2B-6-004.	
4	Thermal expansion: Fig. 2B-6-005, Fig. 2B-6-006.	
5a	Dielectric constant: Table 2B-6-001, Fig. 2B-6-007. $LiNb_{0.1}Ta_{0.9}O_3$: $\kappa_{33}^{T} = 45.8, \kappa_{33}^{S} = 43.5, \kappa_{11}^{T} = 52.1, \kappa_{11}^{S} = 40.5$ at RT. (κ^{T}: free dielectric constant, κ^{S}: clamped dielectric constant.)	86Wan
7a	Piezoelectric constants: see Table 2B-6-001 in 5a.	
8a	Elastic stiffnesses: see Table 2B-6-001 in 5a.	
9a	Refractive index: Table 2B-6-002.	
13a	NMR: Fig. 2B-6-008.	
16	Optical waveguides: see See also No. 2A-1, No. 2A-2.	75Phi, 75Min, 75Miy, 75Bal

Table 2B-6-001. $LiNb_{0.1}Ta_{0.9}O_3$. Physical constants at RT [86Wan].

Dielectric constants	$\kappa_{11}^{\mathbf{T}}$	52.1	Elastic constants	$c_{11}^{\boldsymbol{E}}$	2.32
	$\kappa_{33}^{\mathbf{T}}$	45.8	[$\cdot 10^{11}$ Nm^{-2}]	$c_{12}^{\boldsymbol{E}}$	0.48
	$\kappa_{11}^{\mathbf{S}}$	40.5		$c_{13}^{\boldsymbol{E}}$	0.80
	$\kappa_{33}^{\mathbf{S}}$	43.5		$c_{14}^{\boldsymbol{E}}$	0.022
Piezoelectric constants	e_{15}	2.64		$c_{33}^{\boldsymbol{E}}$	2.67
[Cm^{-2}]	e_{22}	2.24		$c_{44}^{\boldsymbol{E}}$	0.94
	e_{31}	–0.001			
	e_{33}	1.78			

Table 2B-6-002. $LiNb_{1-x}Ta_xO_3$. Refractive indices at 20 °C [77Shi2].

λ	x = 0.81		x = 0.92		x = 0.97		x = 1.00	
[nm]	n_o	n_e	n_o	n_e	n_o	n_e	n_o	n_e
589.3	2.2057	2.1986	2.1984	2.1946	2.1902	2.1933	2.1862	2.1910
632.8	2.1954	2.1888	2.1888	2.1853	2.1800	2.1829	2.1766	2.1815
800.0	2.1702	2.1638	2.1643	2.1604	2.1561	2.1589	2.1531	2.1579
850.0	2.1666	2.1606	2.1598	2.1559	2.1516	2.1545	2.1484	2.1529
900.0	2.1615	2.1553	2.1557	2.1519	2.1478	2.1507	2.1446	2.1491
1060.0	2.1517	2.1457	2.1460	2.1422	2.1385	2.1413	2.1351	2.1396

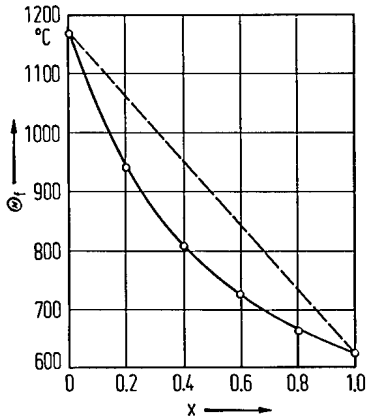

Fig. 2B-6-001. $LiNb_{1-x}Ta_xO_3$. Θ_f vs. x [77Shi1]. Θ_f: ferroelectric transition temperature of crystals grown from $LiNb_{1-x}Ta_xO_3$ melt. Θ_f of $LiNb_{1-x}Ta_xO_3$ ceramics (dashed curve) is linearly dependent on x, see [65Sha].

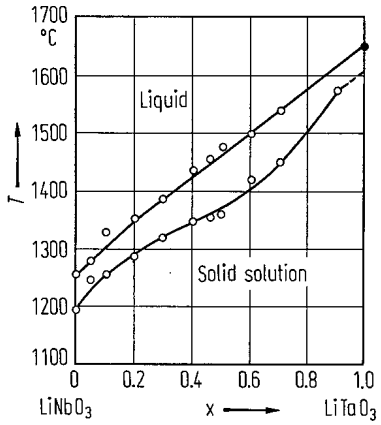

Fig. 2B-6-002. (1–x)$LiNbO_3$·x $LiTaO_3$. Phase diagram [70Pet]. The reason why the two curves do not meet at either end of the pseudo-binary section is that the stoichiometric and congruently melting composition do not coincide.

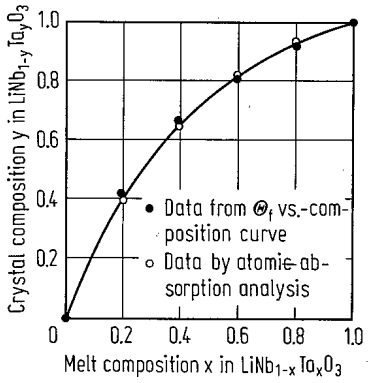

Fig. 2B-6-003. $LiNb_{1-x}Ta_xO_3$. Correlation between composition x of melts and composition y of crystals grown from the melts [77Shi1].

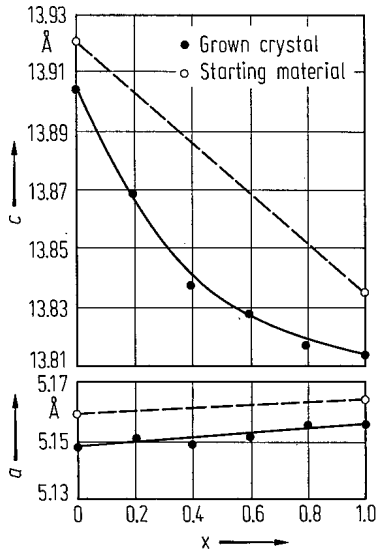

Fig. 2B-6-004. $LiNb_{1-x}Ta_xO_3$. Lattice parameters vs. x [77Shi1]. x: melt composition. See also [65Sha].

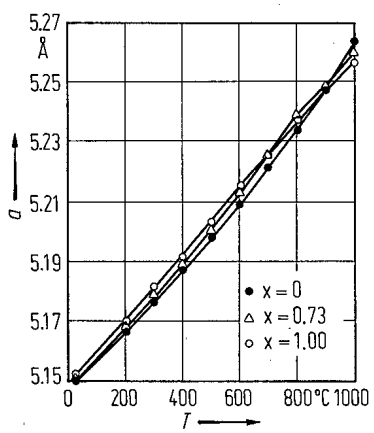

Fig. 2B-6-005. $LiNb_{1-x}Ta_xO_3$. *a* vs. *T* [76Sug]. *a*: lattice constant. Parameter: x. See also [77Shi1].

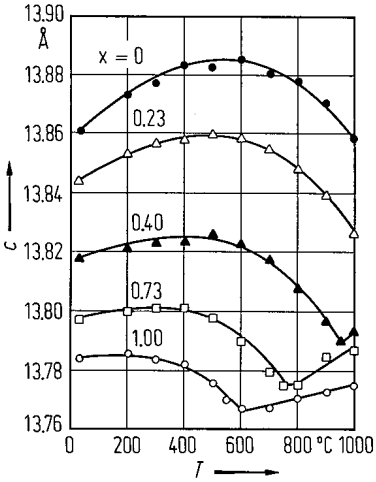

Fig. 2B-6-006. $LiNb_{1-x}Ta_xO_3$. *c* vs. *T* [76Sug]. *c*: lattice constant. Parameter: x. See also [77Shi1].

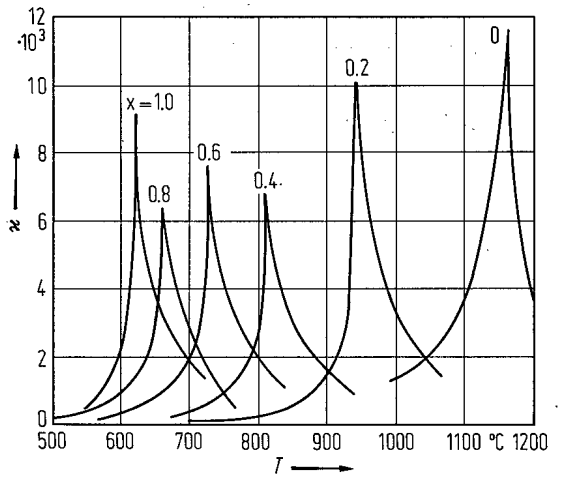

Fig. 2B-6-007. $LiNb_{1-x}Ta_xO_3$. κ vs. T [77Shil]. Parameter: x. x: melt composition. f = 1 MHz.

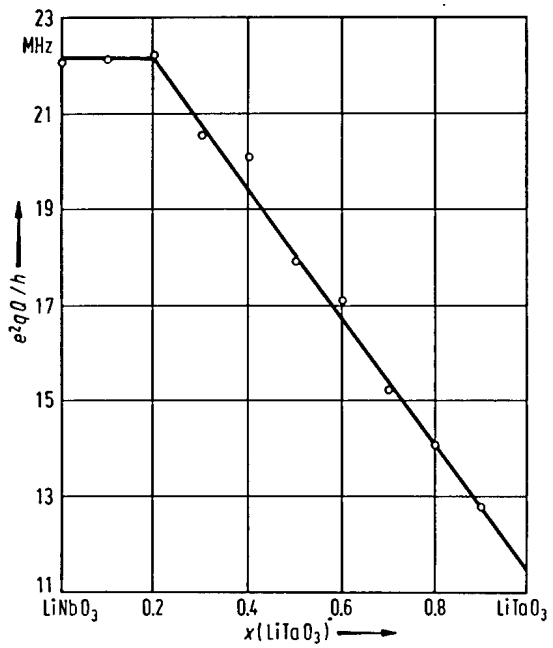

Fig. 2B-6-008. $LiNb_{1-x}Ta_xO_3$. e^2qQ/h vs. x for ^{93}Nb NMR [70Pet].

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