No. 1B-c19 $Pb(Sc_{1/2}Ta_{1/2})O_3$
(M = 368.2)

1a Ferroelectricity in $Pb(Sc_{1/2}Ta_{1/2})O_3$ was discussed by Smolenskii et al. in 1959. 59Smo

b

phase	II	I	
state	F	P	59Smo
crystal system	rhombohedral [a])	cubic	[a])85Gro
space group	$R3m-C_{3v}^5$ or $R3-C_3^4$	$Pm3m-O_h^1$	
Θ [K]	270.0(1)		

2a Crystal growth: flux method. 80Set1

3a $a = b = c$ = 4.0760(2) Å at RT. 85Gro

b Crystal structure: The large number of superstructure lines and great intensity in $Pb(Sc_{1/2}Ta_{1/2})O_3$ indicates that the degree of ordering of Sc^{3+} and Ta^{5+} ions is greater than in $Pb(Sc_{1/2}Nb_{1/2})O_3$. 59Ism

4 Lattice distortion: Fig. 1B-c19-001.

5a Dielectric constant: Figs. 1B-c19-002...1B-c19-008.

c Polarization: Fig. 1B-c19-009.
Coercive field: Fig. 1B-c19-010.

7b Electrostriction: Table 1B-c19-001.

9a Birefringence: Fig. 1B-c19-011.

14 Electron microscopic observations of ordered and disordered phases of $Pb(Sc_{1/2}Ta_{1/2})O_3$: see 86Ran
Observations by electron diffraction of new super-lattice reflections and diffuse scattering in both the paraelectric and ferroelectric phases: see 86Ran

15a Domain structure was observed at low temperature by polarized light [a]) 81Set
and transmission electron microscope [b]). [b])86Ran
High resolution electron microscopic study of domain structure: 92Pen, 93Pen

16 $Pb(Sc_{1/2}Ta_{1/2})O_3$ thin film: see 91Pat

Table 1B-c19-001. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (crystal). C, Q_h, $\Delta T/\Delta p$ for various samples [80Set2]. C: Curie-Weiss constant. Q_h: electrostrictive constant, $Q_h = Q_{11} + 2Q_{12}$. s: order parameter. δ: diffuseness parameter calculated from the formula $\kappa^{-1} = 1/\kappa_{max} + (2Q_hC)^2(p - p_0(T))^2/2\kappa_{max}\delta^2$, where $p_0(T) = (Q_{max} - T)/2Q_hC$, and κ_{max} is the maximum value of κ at $p = 0$ and Q_{max} is the temperature where $\kappa = \kappa_{max}$.

	Diffuseness parameters	C [$\cdot 10^5$ K]	Q_h [$\cdot 10^{-2}$ m^{4}C^{-2}]	$\Delta T/\Delta p$ [$\cdot 10^{-8}$ KPa^{-1}]
disordered crystal	$\delta = 45°$ (52°)			
(s = 0.35)	$1/\kappa_{max} = 8.6 \cdot 10^{-5}$	2.8	0.88	–3.6
disordered ceramic	$\delta = 38°$ (45°)			
(s = 0.40)	$1/\kappa_{max} = 5.0 \cdot 10^{-5}$	3.0	0.95	–3.8
ordered ceramic				
(s = 0.85)		2.9	0.80(5)	–3.1
ordered crystal				
(s = 0.80)		2.4	0.85	–2.0
average value		2.80(25)	0.87(6)	

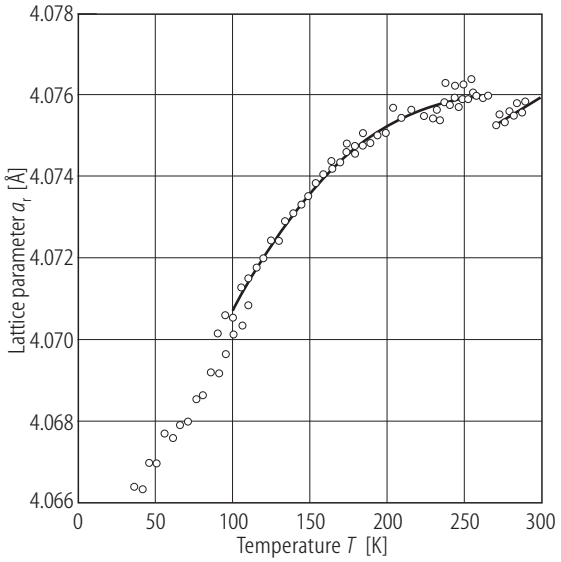

Fig. 1B-c19-001. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (crystal). a_r vs. T [85Gro]. a_r: unit cell parameter for the rhombohedral axis.

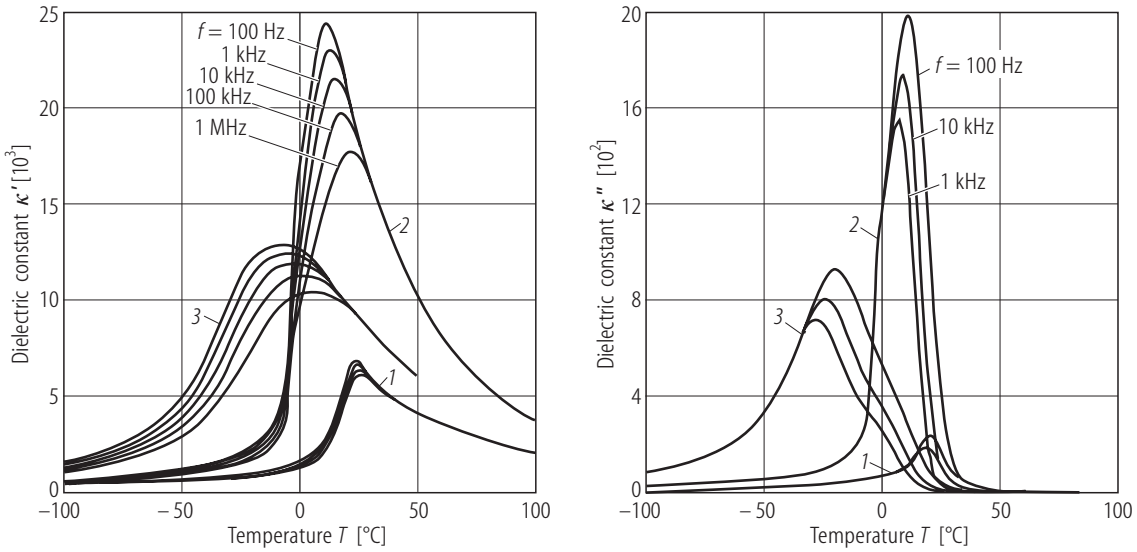

Fig. 1B-c19-002. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (ceramics). κ', κ'' vs. T [93Chu]. Parameter: f. Curve *1*: stoichiometric highly ordered sample (s = 0.90). *2*: stoichiometric highly disordered sample (s = 0). *3*: highly disordered sample (s = 0) with lead vacancies. s: order parameter.

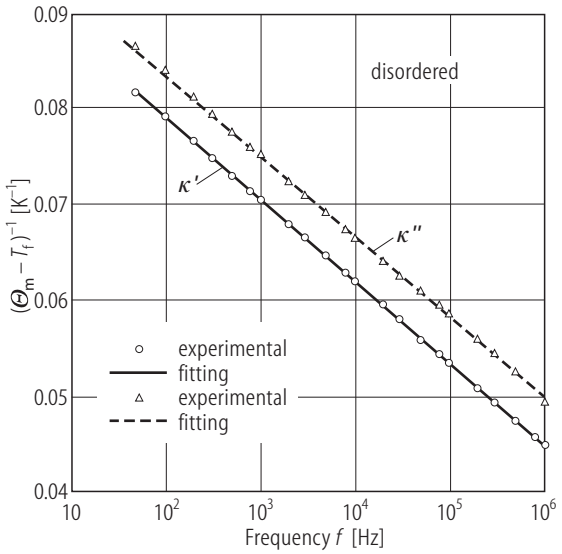

Fig. 1B-c19-003. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (ceramics). $(\Theta_m - T_f)^{-1}$ vs. T [93Chu]. Θ_m: the temperatures of κ' or κ'' maximum. T_f: a constant in the Vogel-Fulcher equation $f = f_0 \exp[-E/(\Theta_m - T_f)]$. The solid and broken curves are fitting of the Vogel-Fulcher equation with $f_0 = 1.65 \cdot 10^{11}$ Hz, T_f = 270.78 K, E = 267.8 K, and $f_0 = 9.99 \cdot 10^{11}$ Hz, T_f = 265.8 K, E = 275.9 K, respectively. Stoichiometric highly disordered sample.

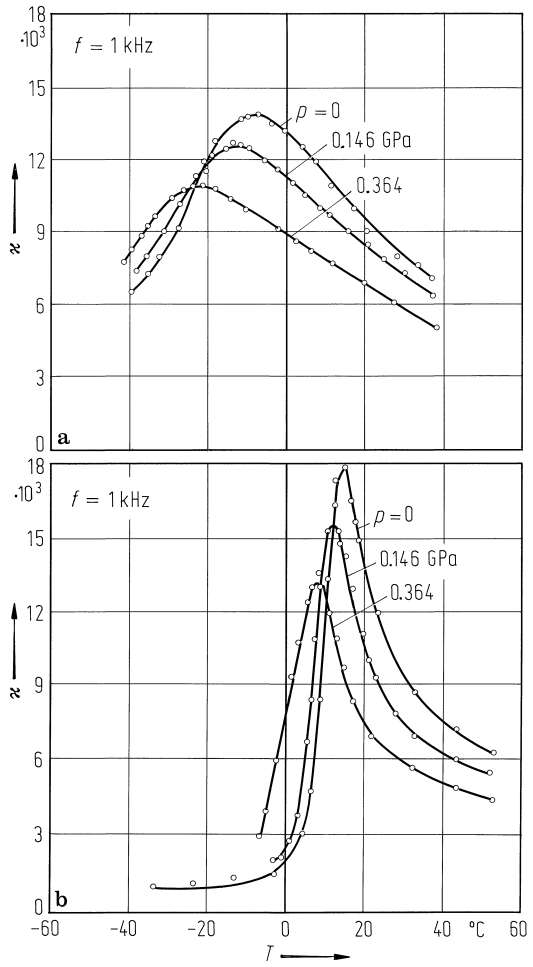

Fig. 1B-c19-004. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (crystal). κ vs. T [80Set2]. Parameter: p. **(a)** s = 0.35 (disordered). **(b)** s = 0.80 (ordered). s: order parameter.

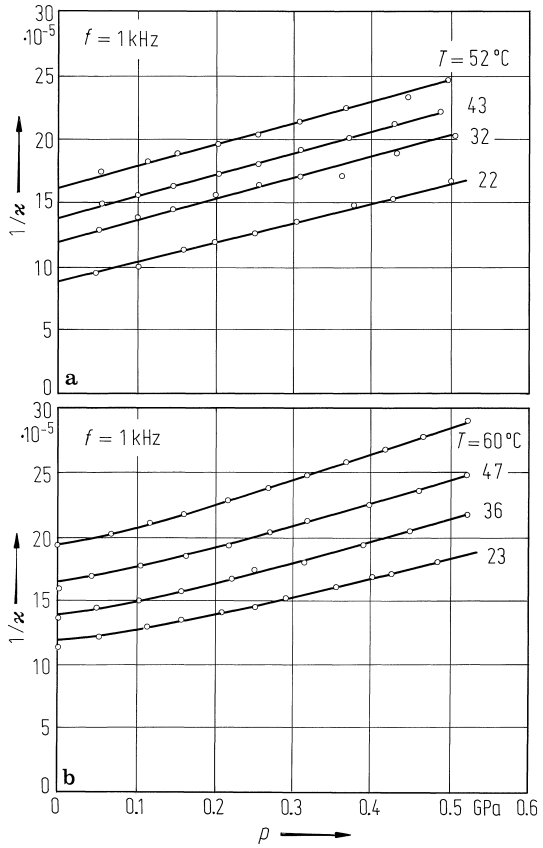

Fig. 1B-c19-005. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (crystal). κ^{-1} vs. p [80Set2]. Parameter: T. **(a)** s = 0.80 (ordered). **(b)** s = 0.35 (disordered). s: order parameter.

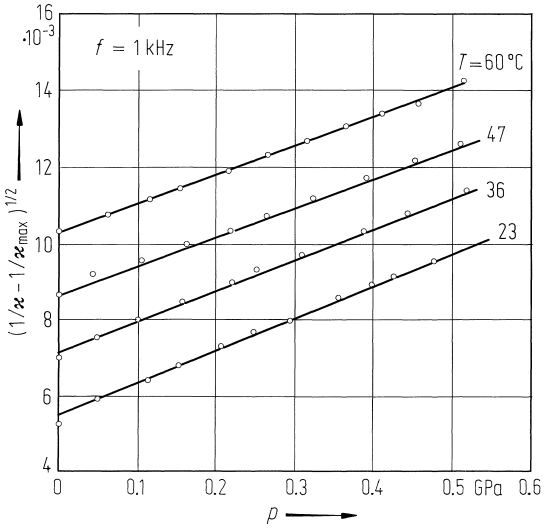

Fig. 1B-c19-006. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (crystal). $(\kappa^{-1} - \kappa_{max}^{-1})^{1/2}$ vs. p [80Set2]. Parameter: T. κ_{max}: the maximum value of κ at $p = 0$. Specimen: disordered single crystals.

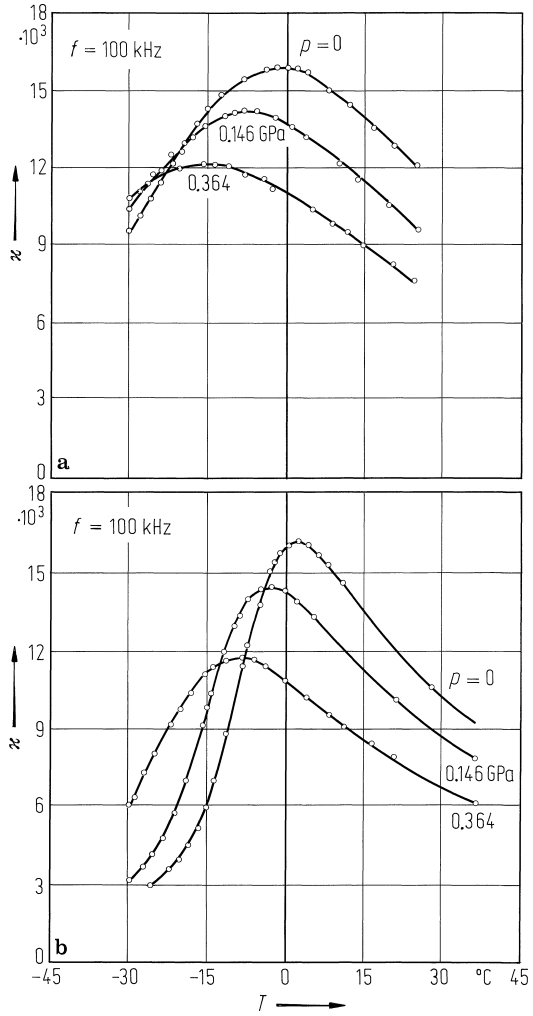

Fig. 1B-c19-007. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (crystal). κ vs. T [80Set2]. Parameter: p. **(a)** s = 0.40 (disordered). **(b)** s = 0.85 (ordered). s: order parameter.

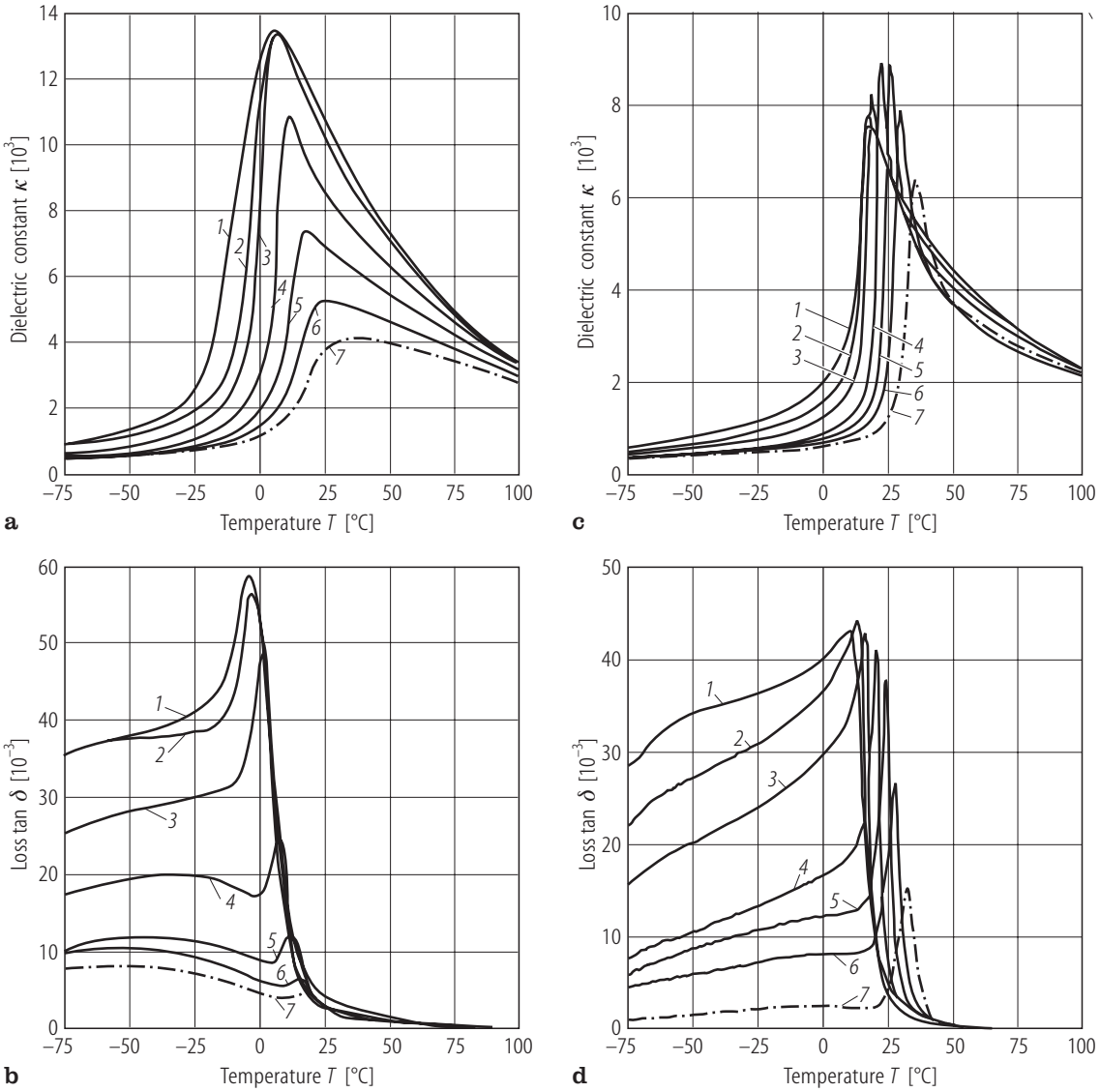

Fig. 1B-c19-008. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (ceramics). κ', $\tan\delta$ vs. T [92Dag]. Parameter: E_{bias}. **(a)**, **(b)**: disordered sample (s = 0). **(c)**, **(d)**: ordered sample (s = 0.84). s: degree of order determined by X-ray diffraction. Curve *1*: E_{bias} = 0; *2*: 0.25 MVm^{-1}; *3*: 0.5 MVm^{-1}; *4*: 1.0 MVm^{-1}; *5*: 1.5 MVm^{-1}; *6*: 2.0 MVm^{-1}; *7*: 2.5 MVm^{-1}.

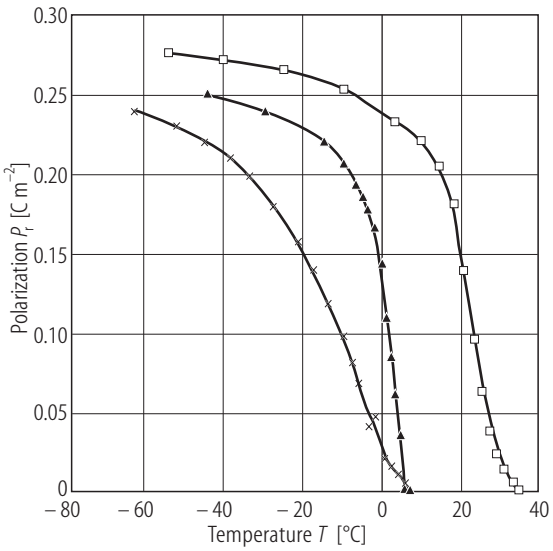

Fig. 1B-c19-009. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (ceramics). P_r vs. T [93Chu]. Open squares: stoichiometric highly ordered sample. Full triangles: stoichiometric highly disordered sample. Crosses: highly disordered sample with lead vacancies.

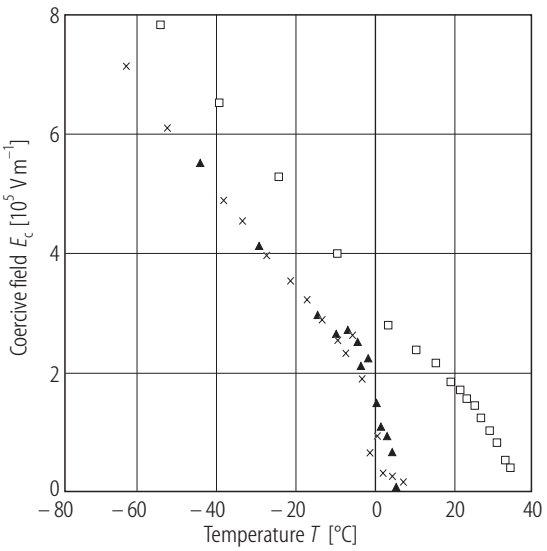

Fig. 1B-c19-010. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (ceramics). E_c vs. T [93Chu]. Open squares: stoichiometric highly ordered sample. Full triangles: stoichiometric highly disordered sample. Crosses: highly disordered sample with lead vacancies.

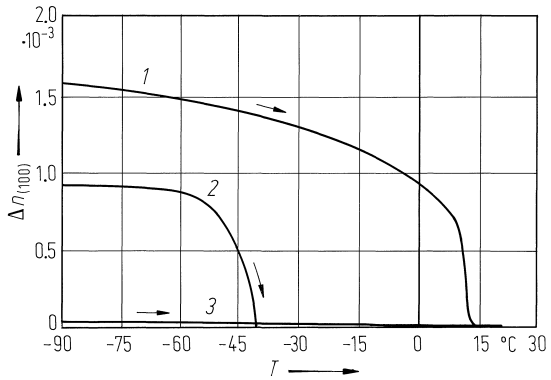

Fig. 1B-c19-011. $Pb(Sc_{1/2}Ta_{1/2})O_3$ (ceramics). $\Delta n_{(100)}$ vs. T [81Set]. Curve *1*: ordered; *2*: disordered, cooled under E of $1 \cdot 10^3$ kVm^{-1}; *3*: disordered, cooled without E. λ = 632.8 nm.

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