No. 39A-3 $(NH_4)_2BeF_4$, Ammonium fluoroberyllate

(M = 121.08; [D: 129.13])

1a Ferroelectric activity in $(NH_4)_2BeF_4$ was discovered by Pepinsky and Jona in 1957. 57Pep

b	phase	III	II	I
	state	F [b) c)]		P
	crystal system	orthorhombic		orthorhombic
	space group	$Pn2_1a$– C_{2v}^9 [b) c) d)]		Pnam– D_{2h}^{16} [a) b) c)]
	Θ [K]	176 [e)]	182 [f)]	

[a]) 44Muk
[b]) 74Mak
[c]) 77Ono
[d]) 77Tak
[e]) 77Iiz
[f]) 73Str

P_s || [010]. 57Pep
$\rho_X = 1.718 \cdot 10^3$ kg m^{-3} at –84 °C. 79Ono
Transparent, colorless. 57Pep

2a Crystal growth: evaporation or cooling method from aqueous solution. 58Hos

3a Unit cell parameters: Table 39A-3-001.
a = 7.646(1) Å, b = 10.430(1) Å, c = 5.918(1) Å at 20(1) °C (phase I). 78Ono
a = 7.573(5) Å, b = 10.462(5) Å, c = 5.910(4) Å at –84 °C (phase I),
a = 15.1048(11) Å, b = 10.4821(6) Å, c = 5.9101(3) Å at –140 °C (phase III). 79Ono

b Z = 4 in phase I, Z = 8 in phase III. 79Ono
Crystal structure in phase I: Table 39A-3-002, Table 39A-3-003, Table 39A-3-004, Table 39A-3-005, Table 39A-3-006, Table 39A-3-007, Table 39A-3-008; Fig. 39A-3-001, Fig. 39A-3-002.
Crystal structure of phase II based on superspace group: see 85Yam
Crystal structure of phase III: Table 39A-3-009, Table 39A-3-010, Table 39A-3-011, Table 39A-3-012, Table 39A-3-013; Fig. 39A-3-003, Fig. 39A-3-004, Fig. 39A-3-005, Fig. 39A-3-006; see also 80Mis
Thermal displacements of atoms: Table 39A-3-014.

4 Thermal expansion: Fig. 39A-3-007, Fig. 39A-3-008.
Thermal expansion coefficient: Table 39A-3-001 in 3a; Fig. 39A-3-009.

5a Dielectric constant: Fig. 39A-3-010, Fig. 39A-3-011;
see also 86Lei, 88Str
Dielectric dispersion: Fig. 39A-3-012.
Dielectric constant in far infrared region: Fig. 39A-3-013, Fig. 39A-3-014.
Dielectric constant of $(SO_4)^{2-}$ doped crystal and γ-irradiated crystal: see 84Str
Effect of p on κ: Fig. 39A-3-015.
Phase diagram in regard to p: Fig. 39A-3-016;
see also Fig. 39A-2-015 in No. 39A-2.

b Effect of E_{bias}: see 85Str, 87Str
Phase diagram in regard to E_{bias}: Fig. 39A-3-017.
Dielectric hysteresis loop in the vicinity of $\Theta_{III–II}$: see 82Str

c Spontaneous polarization: Fig. 39A-3-018.
Coercive field: Fig. 39A-3-019.

6a Heat capacity: Fig. 39A-3-020, Fig. 39A-3-021; see also 86Str
Transition heat, transition entropy: Table 39A-3-015.

7a	Piezoelectric constant: Fig. 39A-3-022. Electromechanical coupling constant: Fig. 39A-3-023.	
8a	Elastic compliance and stiffness: Table 39A-3-016; Fig. 39A-3-024, Fig. 39A-3-025, Fig. 39A-3-026, Fig. 39A-3-027. Elastic stiffness determined by X-ray diffuse scattering: see Effect of *p* on sound velocity and attenuation: Table 39A-3-017; Fig. 39A-3-028, Fig. 39A-3-029, Fig. 39A-3-030.	80Gar
9a	Birefringence: Fig. 39A-3-031.	
b	Electrooptic effect: Fig. 39A-3-032.	
d	Gyration tensor: Fig. Fig. 39A-3-033.	
e	Second harmonic generation: Fig. 39A-3-034; see also	84Aru
10a	Raman scattering: Fig. 39A-3-035.	
b	Sound velocity and attenuation from Brillouin scattering, see Fig. 39A-3-028, Fig. 39A-3-029, Fig. 39A-3-030 in 8a; see also	76Ale
13a	NMR of proton and deuteron: Table 39A-3-018; Fig. 39A-3-036. See also Fig. 39A-1-041 in No. 39A-1. NMR of ^{9}Be: Table 39A-3-019; Fig. 39A-3-037, Fig. 39A-3-038. NMR of ^{14}N: Fig. 39A-3-039, Fig. 39A-3-040, Fig. 39A-3-041. NMR of ^{19}F: Fig. 39A-3-042; see also	67ORe, 69Ale1
b	ESR for irradiated crystal: see	78Mat, 79Mat
14a	Bragg reflections due to structural modulations: Fig. 39A-3-043, Fig. 39A-3-044, Fig. 39A-3-045. For $(NH_4)_2(BeF_4)_{1-x}(NH_4)_x$, see	90Alm
b	X-ray diffuse scattering: Fig. 39A-3-046, Fig. 39A-3-047; see also	77Tak
15a	Domain structure: striped domain pattern parallel to the (100) plane was observed by dew method and scanning electron microscope.	63Tos, 85Rod
16	Surface layer effect on the dielectric constant: see	78Rao