No. 46A-8 $(CH_3)_2NH_2Al(SO_4)_2 \cdot 6H_2O$, Dimethylammonium aluminum sulfate hexahydrate

(M = 373.29; [D: 393.42])

1a Ferroelectricity in$(CH_3)_2NH_2Al(SO_4)_2 \cdot 6H_2O$ was first reported by Kirpichnikova et al. in 1988. 88Kir

b

phase	II	I	88Kir
state	F	P	
crystal system	monoclinic	monoclinic	[a]) 93Pie1
space group	$Pn-C_s^{2}$ [a])	$P2_1/n-C_{2h}^{5}$ [b])	[b]) 93Pie2
Θ [K]	152		88Kir

P_s makes an angle 43° from the a axis in the (101) plane. *) 88Kir
$\rho_X = 1.646 \cdot 10^3$ kg m^{-3} at 295 K. 93Pie2

*) Here the crystal axes are chosen as adoped in [93Pie2]. Then the a axis corresponds to the c axis in [88Kir]; see Fig. 46A-8-004.

2a Crystal growth: evaporation of aqueous solution. 88Kir

3a Unit cell parameters:
Phase I:
a = 6.403(1) Å, b = 10.747(2) Å, c = 11.282(2) Å, β = 100.47(3)°. T = 295 K. 93Pie2
Kiosse et al. used different crystallogrphic systems. 94Kio
The unit cell parameters given are:
a' = 11.849(4) Å, b' = 6.415(2) Å, c' = 10.768(4) Å, γ' = 68.13(9)°. T = 295 K. 94Kio
Relation between two axial systems: $\boldsymbol{a'} = \boldsymbol{a} + \boldsymbol{c}$, $\boldsymbol{b'} = \boldsymbol{c}$, $\boldsymbol{c'} = \boldsymbol{b}$.
Phase II:
a = 6.445(1) Å, b = 10.688(2) Å, c = 11.109(2) Å, β = 99.71(3)°. T = 95 K. 93Pie1

b Z = 2 in phases I [a]) and II [b]). [a]) 93Pie1 [b]) 93Pie2

Crystal structure:
Structure of phase I: Table 46A-8-001, Table 46A-8-002, Table 46A-8-003;
Fig. 46A-8-001, Fig. 46A-8-002.
Structure of phase II: Table 46A-8-004, Table 46A-8-005, Table 46A-8-006;
Fig. 46A-8-003.

5a Dielectric constant: Fig. 46A-8-004.
Dielectric dispersion: Fig. 46A-8-005, Fig. 46A-8-006, Fig. 46A-8-007, Fig. 46A-8-008.
Curie Weiss law: $\kappa_0 = \kappa_\infty + C/(T - \Theta_p)$, $T > \Theta_{II-I}$, where $C = 2.81 \cdot 10^3$ K, Θ_p = 150.9 K, 91Sob1
κ_∞ = 5. κ_0: static dielectric constant.
Phase diagram with regard to p: Fig. 46A-8-009.

b Nonlinear dielectric properties: Fig. 46A-8-010.
$E = (1/\chi_p)P + \xi P^3 + \zeta P^5$ where $\xi = 4.0(5) \cdot 10^{12}$ V m^5 C^{-3}, $\zeta = 1.8 \cdot 10^{17}$ V m^9 C^{-5}. 89Cac

c Spontaneous polarization and coercive field: Fig. 46A-8-011;
see also 95Pyk

9a Refractive indices: $n_{X'}$ = 1.4472, $n_{Y'}$ = 1.4683, $n_{Z'}$ = 1.4706. 89Kir
For relation between the optical axes X', Y', Z' and the crystallographic axes a, b, c, see Fig. 46A-8-004.
Birefringence: see 89Kir

10a	Raman scattering: see	90Tor
16	Rectangular mechanical hysteresis curve (stress-strain) is observed at RT:	
	spontaneous strain: $\approx 10^{-1}$, coercive stress ≈ 5 MPa.	89Kir
	Plasticity and mechanical twin formation: see	89Kir, 90Kir