## No. 39A-2 $K_2SeO_4$, Potassium selenate

($M$ = 221.15)

1a Ferroelectric activity in $K_2SeO_4$ was discovered by Aiki et al. in 1969. 69Aik

b

| phase | IV | III *) | II | I |
|---|---|---|---|---|
| state | F [a]) | | | P |
| crystal system | orthorhombic | | orthorhombic | hexagonal |
| space group | $Pna2_1 - C_{2v}^{9}$ [d]) | | $Pnam - D_{2h}^{16}$ [c]) | $P6_3/mmc - D_{6h}^{4}$ [b]) |
| $\Theta$ [K] | 93 | | 129.5 | 745.0 |

[a]) 69Aik
[b]) 76Saw
[c]) 70Kal
[d]) 74Oha

*) Incommensurately modulated phase. See 77Iiz, 72Shi

$P_s$ || [001]. 70Aik1

$\rho = 3.052 \cdot 10^3$ kg m$^{-3}$, $\rho_X = 3.032 \cdot 10^3$ kg m$^{-3}$ in phase II. 70Kal

Transparent. 70Aik1

2a Crystal growth: evaporation method from aqueous solution. 70Aik1

3a Unit cell parameters: $a_H$ = 6.077 Å, $c_H$ = 8.029 Å at 500 °C in phase I. 84Iwa
See also 94Che
$a$ = 7.661(4) Å, $b$ = 10.466(8) Å, $c$ = 6.003(3) Å in phase II. 70Kal
See also 74Oha
$a$ = 22.716 Å, $b$ = 10.339 Å, $c$ = 5.967 Å at 80 K in phase IV. 84Yam1

b $Z$ = 2 in phase I, $Z$ = 4 in phase II, $Z$ = 12 in phase IV.
Crystal structure: Table 39A-2-001, Table 39A-2-002, Table 39A-2-003, Table 39A-2-004, Table 39A-2-005; Fig. 39A-2-001, Fig. 39A-2-002.
Thermal motions of $SeO_4$: see Table 39A-3-005, Table 39A-3-006 in No. 39A-3.
Crystal structure of phase III based on the superspace group: see 89Per, 84Yam2, 87Yam

4 Thermal expansion: Fig. 39A-2-003.
Thermal expansion coefficient: Fig. 39A-2-004.

5a Dielectric constant: Fig. 39A-2-005, Fig. 39A-2-006, Fig. 39A-2-007, Fig. 39A-2-008, Fig. 39A-2-009.
Dielectric constant in the submillimeter region: Fig. 39A-2-010, Fig. 39A-2-011.
Effect of $p$ on dielectric constant: Fig. 39A-2-012, Fig. 39A-2-013.
Phase diagram in regard to $p$: Fig. 39A-2-014, Fig. 39A-2-015.
For $\kappa$ in the infrared region, see subsection 9a.
$[d\Theta_{III-II}/dp]_{p=0}$ = –65 K GPa$^{-1}$, $[d\Theta_{IV-III}/dp]_{p=0}$ = –90 K GPa$^{-1}$. 80Pre
See also 81Kud1, 81Sam

Effect of uniaxial stress on $\Theta_{III-II}$: Fig. 39A-2-016.

b Effect of $E_{bias}$ on $\Theta_{IV-III}$: Fig. 39A-2-017.

c Spontaneous polarization and coercive field: Fig. 39A-2-18, Fig. 39A-2-019.

6a Heat capacity: Fig. 39A-2-020.
Transition heat, transition entropy: Table 39A-2-006.
See also 95Hag

b Thermal conductivity: Fig. 39A-2-021.

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|---|---|---|
| 8a | Elastic compliance and stiffness: Fig. 39A-2-022, Fig. 39A-2-023, Fig. 39A-2-024, Fig. 39A-2-025, Fig. 39A-2-026; see also | 80Hos |
| | Effects of stress on elastic stiffness: see | 90Bil |
| 9a | Refractive indices: $n_a = 1.549$, $n_b = 1.539$, $n_c = 1.543$ at $\lambda = 514.5$ nm. | 82Hau |
| | Birefringence: Fig. 39A-2-027, Fig. 39A-2-028; see also | 91Kro |
| | Infrared spectra: Fig. 39A-2-029, Fig. 39A-2-030; see also | 86Ech |
| | Absorption: Fig. 39A-2-031. | |
| b | Electrooptic effect: Fig. 39A-2-032. | |
| c | Piezooptic constant (photoelastic effect): Table 39A-2-007. | |
| d | Gyration tensor: Fig. 39A-2-033. | |
| e | Nonlinear susceptibility for SHG: Table 39A-2-008. | |
| | See also | 82Aru |
| 10a | Raman scattering: Fig. 39A-2-034, Fig. 39A-2-035, Fig. 39A-2-036, Fig. 39A-2-037; see also | 88Kat |
| b | Brillouin scattering: Fig. 39A-2-038, Fig. 39A-2-039, Fig. 39A-2-040. | |
| | See also | 81Cho |
| | Elastic stiffness obtained from Brillouin scattering, see subsection 8a. | |
| 13a | NMR of $^{39}K$: Fig. 39A-2-041; see also | 88Top, 90Top |
| | NMR of $^{77}Se$: | 88Top |
| b | ESR of $(SeO_4)^-$: Fig. 39A-2-042; see also | 70Aik2, 84Dan, 90Syl |
| | ESR of $(VO_2)^+$ doped crystal: see | 82Fuk, 85Ook |
| | ESR of $Tl^{2+}$ doped crystal: see | 85Bli, 90Gri |
| | ESR of $Cu^{2+}$ doped crystal: see | 72Kob, 90Zwa |
| 14a | Bragg reflections due to structural modulations: Fig. 39A-2-043, Fig. 39A-2-044, Fig. 39A-2-045, Fig. 39A-2-046. | |
| | Effect of $p$: Fig. 39A-2-047. | |
| b | X-ray diffuse scattering: Fig. 39A-2-048, Fig. 39A-2-049, Fig. 39A-2-050. | |
| | Neutron inelastic scattering: Fig. 39A-2-051, Fig. 39A-2-052, Fig. 39A-2-053, Fig. 39A-2-054. | |