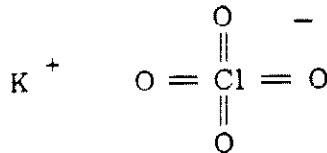


Ref

1. NAME: Potassium Perchlorate (KP), Potassium Hyperchlorate
2. STRUCTURE:



Empirical Formula: $KClO_4$

3. PHYSICAL PROPERTIES:

| | |
|--|---------------|
| Physical State: Crystalline Solid | 1,2,3, 4,5 |
| Color: Colorless | 1,2,3, 4,5 |
| Molecular Weight: 0.138 55 kg/mol | 1,2,5 |
| Oxygen Balance: +46.2% | 2,3 |
| Density (ρ): 2.52 Mg/m ³ at 283 K | 1,3 |
| 2.529 8 Mg/m ³ at 298 K | 4 |
| 2.535 74 \pm 0.000 1 Mg/m ³ at 273 K | 2 |
| M.P.*: 798 K (525 ^o C) | 4 |
| d 861 K (588 ^o C) | 2 |
| 883 \pm 10 K (610 \pm 10 ^o C) | 1,3,5 |
| B.P.: d 926 K (d 653 ^o C) | 4,5 |
| Solubility(s—sol., sl—slightly sol., i—insol., d—decomposes): | |
| s—hot H ₂ O (21.8 g/100 ml H ₂ O at 373 K) | 1,5 |
| (18.2 g/100 ml H ₂ O at 373 K) | 2 |
| sl—cold H ₂ O (0.75 g/100 ml H ₂ O at 273 K) | 1,2,5 |
| (1.68 g/100 parts H ₂ O at 293 K) | 4 |
| i—ether, alcohol | 1,3 |
| see also T-01 in Section 10 | |

*Melting point values in the literature vary from 798 to 883 K, with and without mention of decomposition.

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| | <u>Ref</u> |
|--|------------|
| 3. PHYSICAL PROPERTIES (Cont'd): | |
| Hygroscopicity: Spec. grade: 0.1% wt. gain at 296 K and 93% RH | 5 |
| Purified: <0.1% wt. gain at 296 K and 93% RH | 5 |
| Spectra: | |
| IR: absorption frequencies: 637, 940, 1000, 1075, 1140, 1990 cm^{-1} | 6 |
| 4. THERMAL PROPERTIES: | |
| Heat of Formation (ΔH_f°): -432.75 kJ/mol (-103.43 kcal/mole) | 8 |
| -430.1 \pm 4.2 kJ/mol (-102.8 \pm 1.0 kcal/mole) | 7 |
| -433.5 kJ/mol (-103.6 kcal/mole) | 5 |
| Heat of Transition (ΔH_t) and Transition Temperature: Rhombic \rightarrow Cubic | |
| 13.77 kJ/mol at 572 K (3.29 kcal/mole at 299 $^\circ$ C) | 5 |
| Heat Capacity (C_p°): 795.1 J/(kg \cdot K) (26.33 cal/(mole \cdot $^\circ$ C)) | 5 |
| Coefficient of Cubic Thermal Expansion (β): | |
| 14 $\times 10^{-5}$ /K at 195 to 291 K (-78 to +18 $^\circ$ C) | 5 |
| 5. CRYSTAL AND OPTICAL PROPERTIES: | |
| Crystalline Form: Rhombic | 1,4,5 |
| Refractive Index (n_D): $\alpha = 1.471$ 7 | 1 |
| $\beta = 1.472$ 4 | 1 |
| $\gamma = 1.476$ | 1 |
| X-Ray Crystallographic Data: see T-02 and T-03 in Section 10 | |
| 6. ELECTRICAL PROPERTIES: | |
| Magnetic Susceptibility: 4.51 $\times 10^{-10}$ m \cdot kg \cdot s (4.51 $\times 10^{-6}$ cgs) | 6 |
| 4.74 $\times 10^{-10}$ m \cdot kg \cdot s (4.74 $\times 10^{-6}$ cgs) | 6 |
| 4.81 $\times 10^{-10}$ m \cdot kg \cdot s (4.81 $\times 10^{-6}$ cgs) | 6 |
| Specific Conductivity: see F-01 in Section 9 | |
| 7. EXPLOSIVE AND SENSITIVITY PROPERTIES: | |
| Impact Sensitivity: | |
| BuMines (10% point): 1.0 + m with a 2.0 kg wt. | 5 |
| PA (10% point): 1.01 + m with 2.0 kg wt. (40+ in. with 2.0 kg wt.) | 5 |

Ref

8. HAZARDS:

Toxicity:

Humans:

Moderately toxic and irritating to the skin, mucous membranes, and respiratory tract. It may affect the kidneys. Avoid contact with $KClO_4$. The probable lethal dose for humans is 50-500 mg/kg.

5

DoT Hazard Classification: Oxidizer

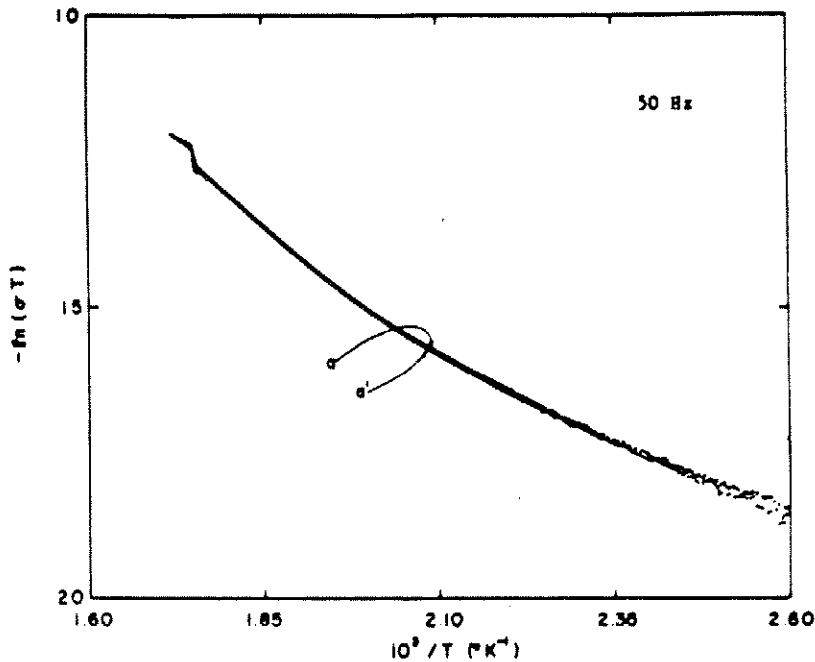
10

Fire and Explosive Hazard:

A fire and explosive hazard, particularly when mixed with organic material, finely divided metals or sulfur. When heated it emits highly toxic fumes. For fighting a fire with mixtures and with potassium perchlorate alone use water.

5

9. FIGURES:



R-09

F-01. Logarithm of specific conductivity (σ) versus reciprocal temperature plots for potassium perchlorate (KP). The digitized data output is shown for the heating cycles only: (a) pure KP, (a') pure KP cooled back to room temperature from $-325^\circ C$ and reheated in a second cycle.

10. TABLES:

| T-01. KClO_4 Solubility in Nonaqueous Solvents at 25°C | |
|---|----------------------|
| Solvent | g./100 g. of solvent |
| Acetone | 0.155 |
| Ethyl acetate | 0.0015 |
| Ethyl alcohol | 0.012 |
| Ethyl ether | insoluble |
| Methyl alcohol | 0.105 |
| Ethyl glycol | 1.03 |

R-05

| T-02. KClO_4 X-Ray Crystallographic Data | | | | | | |
|---|------------------|-------|-------|-------|-------------------------|--|
| System | Space Group | a | b | c | Molecules/ Unit Cell | |
| rhombic | V_h^{16} | 8.834 | 5.650 | 7.240 | 4 | |
| cubic (340°C) | T_d^2 or T^2 | 7.47 | | | | |
| | D_{2h}^{16} | 8.857 | 5.663 | 7.254 | 4 | |

R-05

| T-03. KClO_4 Crystallographic Data | | | | | | | |
|---|--------------------------------------|------------------|--|-------|-------|----------|-------------------------------|
| Compound | System, Structure Type | Space Group | Lattice Constants | | | Ax. Ang. | Molecules per Unit Cell |
| | | | a | b | c | | |
| KClO_4 | Rhombic (BaSO_4) | V_h^{16} | 8.834 | 5.65 | 7.24 | | - |
| | Cubical at 340°C | T_d^2 or T^2 | 7.47 | | | | |
| | | V_h^{16} | 8.84 | 5.65 | 7.23 | | |
| | Orthorhombic | V_h^{16} | 8.834 | 5.650 | 7.240 | | 4 |
| | Cubic | T_d^2 or T^2 | 7.47 | | | | 4 |
| | Rhombic | | 8.85 | 5.67 | 7.26 | | |
| | Rhombic to isotropic at 299-300°C | | | | | | |
| Rhombic, bipyramidal | | | axial ratios, a:b:c = 0.7817:1:1.2792 | | | | |

R-06

Ref

12. MILITARY SPECIFICATIONS:

MIL-P-217A, Amd. 1 (1966) 2

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Data Compiled by H. J. Hoffman