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THE OPTICAL PROPERTIES OF SOME INORGANIC
FLUORIDE AND CHLORIDE COMPOUNDS

T. N. McVay
G. D. White

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METALLURGY DIVISION

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THE OPTICAL PROPERTIES
OF SOME INORGANIC FLUORIDE
AND CHLORIDE COMPOUNDS

T. N. McVay and G. D. White
Metallurgy Division

ABSTRACT

Optical properties are listed for various fluoride and chloride compounds.

INTRODUCTION

In the course of investigation of various inorganic fluoride and chloride systems, it was found advisable to determine the optical properties of numerous fluoride and chloride compounds.

The optical data collected on these substances are recorded in this report. The refractive indices are believed to be precise to ± 0.003 ; the optic angles of biaxial crystals were estimated.

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OPTICAL PROPERTIES

Beryllium lead fluoride, $\text{BeF}_2 \cdot \text{PbF}_2$

Biaxial - $2V = 70^\circ$
 $\alpha = 1.602$ $\gamma = 1.627$
Colorless

Cesium uranium fluoride, $\text{CsF} \cdot \text{UF}_4$

Biaxial + $2V = 45^\circ$
 $\alpha = 1.553$ $\gamma = 1.560$
Polysynthetic twinning, $X \wedge c = 10^\circ$
Z = sky blue X = greenish blue

Cesium uranium fluoride, $2 \text{CsF} \cdot \text{UF}_4$

Biaxial + $2V = 45^\circ$
 $\alpha = 1.516$ $\gamma = 1.524$
Z = light blue X = light greenish blue

Cesium zirconium fluoride, $\text{CsF} \cdot \text{ZrF}_4$

Biaxial - $2V = 20^\circ - 45^\circ$ (varies)
 $\alpha = 1.464$ $\gamma = 1.476$
Colorless

Cesium zirconium fluoride, $2 \text{CsF} \cdot \text{ZrF}_4$

Uniaxial -
 $\alpha = 1.482$ E = 1.460
Colorless

Iron fluoride, FeF_2

Uniaxial +
 $\alpha = 1.524$ E = 1.540
Brown

Lead uranium fluoride, $\text{PbF}_2 \cdot \text{UF}_4$

Uniaxial -
 $\alpha = 1.750$ E = 1.730
Green

Lead uranium fluoride, $6 \text{PbF}_2 \cdot \text{UF}_4$

Isotropic
 $n = 1.77$
Light blue

Lithium beryllium fluoride, $\text{LiF} \cdot \text{BeF}_2$

Uniaxial +
 $O = 1.312$ $E = 1.319$
Colorless

Lithium chromium fluoride, $3 \text{LiF} \cdot \text{CrF}_3$

Biaxial - $2V = 40^\circ$
X normal to one face
 $\alpha = 1.444$ $\gamma = 1.464$
Green

Lithium uranium fluoride, $\text{LiF} \cdot 2\text{UF}_4$

Biaxial - $2V = 10^\circ$
 $\alpha = 1.584$ $\gamma = 1.600$
Yellowish green

Lithium uranium fluoride, $3 \text{LiF} \cdot \text{UF}_4$

Biaxial + $2V = 45^\circ$
 $\alpha = 1.468$ $\gamma = 1.476$
Z = dark green X = light green

Lithium zirconium fluoride, $\text{LiF} \cdot \text{ZrF}_4$

Biaxial + $2V = 30^\circ$
 $\alpha = 1.468$ $\gamma = 1.476$
Colorless

Lithium zirconium fluoride, $2 \text{LiF} \cdot \text{ZrF}_4$

Uniaxial +
 $O = 1.462$ $E = 1.482$
Colorless

Manganese fluoride, MnF_2

Uniaxial +
 $O = 1.476$ $E = 1.504$
 $O = \text{colorless}$ $E = \text{gray}$

Potassium zirconium fluoride, $\text{KF}\cdot\text{ZrF}_4$

Biaxial + $2V = 75^\circ$
 $\alpha = 1.488$ $\gamma = 1.504$
Colorless

Rubidium beryllium fluoride, $\text{RbF}\cdot\text{BeF}_2$

Biaxial +
 $n_{\text{av.}} = 1.390$ with low birefringence
Colorless

Rubidium uranium fluoride, $\text{Rb}\cdot\text{UF}_4$

Biaxial - $2V = 75^\circ$
 $\alpha = 1.514$ $\gamma = 1.528$
Polysynthetic twinning, $Y \wedge c = 20^\circ$
 $Z = \text{blue}$ $X = \text{green}$

Rubidium uranium fluoride, $2 \text{RbF}\cdot\text{UF}_4$

Biaxial + $2V = 70^\circ$
 $\alpha = 1.473$ $\gamma = 1.487$
 $Z = \text{light violet}$ $X = \text{light green}$

Rubidium uranium fluoride, $3 \text{RbF}\cdot\text{UF}_4$

Isotropic
 $n = 1.438$
Green

Rubidium zirconium fluoride, $2 \text{RbF}\cdot\text{ZrF}_4$

Uniaxial - $E = 1.432$
 $O = 1.438$
Colorless

Rubidium zirconium fluoride, $3 \text{RbF}\cdot\text{ZrF}_4$

Isotropic
 $n = 1.432$
Colorless

Sodium beryllium fluoride, $\text{NaF}\cdot\text{BeF}_2$

Biaxial
 $n = 1.312$ with low birefringence
Length slow
Colorless

Sodium beryllium fluoride, $2 \text{ NaF} \cdot \text{BeF}_2$

Biaxial
 $n = 1.303$ with low birefringence
Yllc
Colorless

Sodium chromium fluoride, $3 \text{ NaF} \cdot \text{CrF}_3$

Isotropic
 $n = 1.411$
Green

Sodium fluoride, acid $\text{NaF} \cdot \text{HF}$

Uniaxial +
 $n_o = 1.261$ $n_e = 1.328$
Colorless

Sodium thorium fluoride, $2 \text{ NaF} \cdot \text{ThF}_4$

Uniaxial +
 $n_o = 1.468$ $n_e = 1.496$
Colorless

Sodium uranium chloride, $2 \text{ NaCl} \cdot \text{UCl}_4$

Uniaxial -
 $n_o = 1.664$ $n_e = 1.652$
Pale green

Sodium uranium fluoride, $\text{NaF} \cdot \text{UF}_4$

Uniaxial -
 $n_o = 1.520$ $n_e = 1.512$
Green

Sodium uranium fluoride, $2 \text{ NaF} \cdot \text{UF}_4$

Uniaxial -
 $n_o = 1.495$ $n_e = 1.490$
Green

Sodium uranium fluoride, $3 \text{ NaF} \cdot \text{UF}_4$

Uniaxial -
 $n_o = 1.417$ $n_e = 1.411$
Greenish blue

Sodium zirconium fluoride, $3 \text{ NaF} \cdot 4 \text{ ZrF}_4$

Biaxial + $2V = 30^\circ$
 $\alpha = 1.420$ $\gamma = 1.432$
Colorless

Sodium zirconium fluoride, $\text{NaF} \cdot \text{ZrF}_4$

Uniaxial -
 $O = 1.508$ $E = 1.500$
Indices vary depending on $\text{NaF}:\text{ZrF}_4$ ratio
Appears to be a solid solution
Colorless

Sodium zirconium fluoride, $2 \text{ NaF} \cdot \text{ZrF}_4$

Biaxial - $2V = 75^\circ$
 $\alpha = 1.412$ $\gamma = 1.419$
Colorless

Sodium zirconium fluoride, $3 \text{ NaF} \cdot \text{ZrF}_4$

Uniaxial -
 $O = 1.386$ $E = 1.381$
Colorless

Thorium fluoride, ThF_4

Isotropic
 $n = 1.532$
Colorless

Uranium chloride (III) UCl_3

Uniaxial, probably -
High index 2.04 $\text{Low index } 1.94$
Dark brownish red

Uranium chloride (III) UCl_4

Uniaxial -
 $O = 2.03$ $E = 1.95$
 $Z = \text{greenish brown}$ $X = \text{light brownish green}$

Zirconium chloride ZrCl_4

Probably monoclinic
Biaxial $\text{Large } 2V$
 $\gamma = 1.83$ $\alpha = 1.76$
 $Z \wedge c 22^\circ$
White