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CRYSTALLOGRAPHIC DATA FOR SOME METAL FLUORIDES, CHLORIDES, AND OXIDES

G. D. Brunton
H. Insley
T. N. McVay
R. E. Thoma

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Reactor Chemistry Division

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FEBRUARY 1965

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ABSTRACT

Optical and x-ray diffraction data are listed for some 250 compounds, mostly complex fluorides.

The complementary application of x-ray and petrographic microscopic techniques within the research programs of the ORNL Reactor Chemistry Division has made possible the synthesis, isolation, and characterization of a large number of pure compounds. Crystallographic data for many of these compounds are contained in this report. In the course of many experimental investigations it has become evident that the existence of both optical and x-ray diffraction data often permits phase identification and chemical inferences to be made which would otherwise be impossible. Attention to the task of obtaining and continually refining such data has therefore been considered to be a worthwhile effort. Some years ago, the available body of optical data was summarized by McVay and White.[1] Later, the compilation was amplified to include x-ray diffraction data and reissued.[2] Since then, many additional compounds have been synthesized; much of the older data has also been refined.

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[1]T. N. McVay and G. D. White, The Optical Properties of Some Inorganic Fluoride and Chloride Compounds, ORNL-1712 (May 5, 1964) (declassified).

[2]H. Insley *et al.*, Optical Properties and X-Ray Diffraction Data for Some Inorganic Fluoride and Chloride Compounds, ORNL-2192 (Oct. 23, 1956).

At this juncture, some of the ORNL technologies which have depended extensively on rapid and accurate identification of crystalline phases, such as the Molten-Salt Reactor Program and the Fluoride Volatility Process, have evolved sufficiently that all the solids which, practically, can be expected to occur in general practice have now been characterized. It is therefore a fitting time for the issuance of this report, which includes a comprehensive collection of the identification data produced during the previous evolutionary stages of these technologies.

The current report uses a new format for which data sheets were produced by a computer from a punched card collection. Such a collection permits continuous accrual of revised and corrected data. The potentiality of rapid revision, which is implicit in this technique, suggests that such compilations as the present one can be maintained on a current basis. While it is expected that this will be done, methods for distributing new information are so cumbersome that our plans for subsequent revision of this document call only for publication of subsequent editions when appropriate.

A few of the compounds listed in this collection were not originally discovered in ORNL researches; in most of such cases, however, some aspects of the identification data are original in this report. Optical measurements were made by H. Insley, T. N. McVay, G. D. White, C. F. Weaver, B. S. Landau, and G. D. Brunton. X-ray diffraction data, unless otherwise noted, were obtained by R. E. Thoma, G. D. Brunton, D. R. Sears, and J. H. Burns.

This document follows a rigid format dictated to some extent in that a computer was used to sort and print the information from punched cards. Explanatory comments on the page format are given below:

1. Compound Name and Formula. Assignment of names and formulas to complex compounds was made according to the recommendations of the IUPAC Commission on Nomenclature of Inorganic Chemistry (1957). The compounds are listed alphabetically in order of their appearance in the periodic table. Wherever possible, references are made to the source of the data and original work even when corrections or refinements of those data have been made.

2. Crystal Symmetry Data, Space Group, Lattice Parameters, and X-Ray Density. Space group symbols used here differ somewhat from those employed in conventional usage because of computer limitation; in each case, the symbols are readily conventionalized.

3. Optical Data. The refractive indices of the compounds listed are believed to be precise to ± 0.002. N_y was not determined in most cases for biaxial compounds because in practice it is not often needed for identification purposes. The angle between the optical axes, 2V, is an estimate. The "#" is the computer printer symbol for "=".

4. X-Ray Data. All of the "d" spacings are printed with four decimal places because of the computer format. The real number of significant figures can usually be inferred from a rapid scan of the data.

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ALUMINUM FLUORIDE	ALF3	1
AMMONIUM BERYLLIUM FLUORIDE	2NH4F.BEF2	2
BERYLLIUM FLUORIDE	BEF2	3
BERYLLIUM OXALATE HYDRATE	BEC2O4.H2O	4
BERYLLIUM OXALATE HYDRATE	BEC2O4.3H2O	5
BERYLLIUM OXIDE	BEO	6
CERIUM FLUORIDE	CEF3	7
BETA CESIUM BERYLLIUM FLUORIDE	2CSF.BEF2	8
GAMMA CESIUM BERYLLIUM FLUORIDE	CSF.BEF2	9
CESIUM LANTHANUM FLUORIDE	3CSF.LAF3	10
CESIUM MAGNESIUM FLUORIDE	CSF.MGF2	11
CESIUM THORIUM FLUORIDE	3CSF.THF4	12
CESIUM THORIUM FLUORIDE	2CSF.THF4	13
CESIUM THORIUM FLUORIDE	CSF.THF4	14
CESIUM THORIUM FLUORIDE	2CSF.3THF4	15
CESIUM THORIUM FLUORIDE	CSF.2THF4	16
CESIUM THORIUM FLUORIDE	CSF.3THF4	17
CESIUM THORIUM FLUORIDE	CSF.6THF4	18
CESIUM URANIUM (IV) FLUORIDE	3CSF.UF4	19
CESIUM URANIUM (IV) FLUORIDE	2CSF.UF4	20
CESIUM URANIUM (IV) FLUORIDE	CSF.UF4	21
CESIUM URANIUM (IV) FLUORIDE	2CSF.3UF4	22
CESIUM URANIUM (IV) FLUORIDE	CSF.6UF4	23
CESIUM ZIRCONIUM FLUORIDE	3CSF.ZRF4	24
BETA CESIUM ZIRCONIUM FLUORIDE	2CSF.ZRF4	25
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IRON (II) ZIRCONIUM FLUORIDE	FEF2.ZRF4	40
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LITHIUM BERYLLIUM FLUORIDE	LIF.BEF2	44
LITHIUM BERYLLIUM ZIRCONIUM FLUORIDE	6LIF.BEF2.ZRF4	45
LITHIUM CHROMIUM (III) FLUORIDE	3LIF.CRF3	46
LITHIUM DYSPROSIUM (III) FLUORIDE	LIF.DYF3	47
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LITHIUM ZIRCONIUM FLUORIDE	3LIF.4ZRF4	68
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POTASSIUM LITHIUM ZIRCONIUM FLUORIDE	KF.LIF.ZRF4	89
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POTASSIUM THORIUM FLUORIDE	3KF.THF4	101
POTASSIUM THORIUM FLUORIDE	2KF.THF4	102
POTASSIUM THORIUM FLUORIDE	7KF.6THF4	103
POTASSIUM THORIUM FLUORIDE	KF.2THF4	104
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POTASSIUM URANIUM (IV) FLUORIDE	2KF.UF4	110
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BETA POTASSIUM ZIRCONIUM FLUORIDE	2KF.ZRF4	116
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ALPHA POTASSIUM ZIRCONIUM FLUORIDE	KF.ZRF4	118
BETA POTASSIUM ZIRCONIUM FLUORIDE	KF.ZRF4	119
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RUBIDIUM BERYLLIUM FLUORIDE	RBF.BEF2	123
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RUBIDIUM SODIUM ZIRCONIUM FLUORIDE	3RBF.3NAF.2ZRF4	133
RUBIDIUM SODIUM ZIRCONIUM FLUORIDE	RBF.NAF.ZRF4	134
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SODIUM CHROMIUM (III) FLUORIDE	3NAF.CRF3	163
SODIUM CHROMIUM (III) FLUORIDE	5NAF.3CRF3	164
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ALPHA SODIUM DYSPROSIUM (III) FLUORIDE	5NAF.9DYF3	167
BETA SODIUM ERBIUM (III) FLUORIDE	NAF.ERF3	168
ALPHA SODIUM ERBIUM (III) FLUORIDE	5NAF.9ERF3	169
BETA SODIUM EUROPIUM (III) FLUORIDE	NAF.EUF3	170
ALPHA SODIUM EUROPIUM (III) FLUORIDE	5NAF.9EUF3	171
ALPHA SODIUM GADOLINIUM (III) FLUORIDE	NAF.GDF3	172
BETA SODIUM GADOLINIUM (III) FLUORIDE	NAF.GDF3	173
ALPHA SODIUM GADOLINIUM (III) FLUORIDE	5NAF.9GDF3	174
SODIUM HAFNIUM FLUORIDE	3NAF.HFF4	175
BETA SODIUM HAFNIUM FLUORIDE	5NAF.2HFF4	176
SODIUM HAFNIUM FLUORIDE	2NAF.HFF4	177
SODIUM HAFNIUM FLUORIDE	7NAF.6HFF4	178
BETA SODIUM HOLMIUM (III) FLUORIDE	NAF.HOF3	179
ALPHA SODIUM HOLMIUM (III) FLUORIDE	5NAF.9HOF3	180
SODIUM HYDROGEN FLUORIDE	NAF.HF	181
SODIUM IRON (II) FLUORIDE	NAF.FEF2	182
SODIUM IRON (II) ZIRCONIUM FLUORIDE	NAF.FEF2.2ZRF4	183
SODIUM LANTHANUM FLUORIDE	NAF.LAF3	184
SODIUM LITHIUM BERYLLIUM FLUORIDE	2NAF.LIF.2BEF2	185
SODIUM LITHIUM THORIUM FLUORIDE	NAF.2LIF.2THF4	186
BETA SODIUM LUTETIUM (III) FLUORIDE	NAF.LUF3	187
ALPHA SODIUM LUTETIUM (III) FLUORIDE	5NAF.9LUF3	188
ALPHA SODIUM NEODYMIUM (III) FLUORIDE	NAF.NDF3	189
BETA SODIUM NEODYMIUM (III) FLUORIDE	NAF.NDF3	190
ALPHA SODIUM NEODYMIUM (III) FLUORIDE	5NAF.9NDF3	191
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SODIUM NICKEL (II) ZIRCONIUM FLUORIDE	NAF.NIF2.2ZRF4	193

SODIUM PLUTONIUM (III) FLUORIDE	NAF.PUF3	194
BETA SODIUM PRASEODYMIUM (III) FLUORIDE	NAF.PRF3	195
ALPHA SODIUM SAMARIUM (III) FLUORIDE	NAF.SMF3	196
BETA SODIUM SAMARIUM (III) FLUORIDE	NAF.SMF3	197
ALPHA SODIUM SAMARIUM (III) FLUORIDE	5NAF.9SMF3	198
BETA SODIUM TERBIUM (III) FLUORIDE	NAF.TBF3	199
ALPHA SODIUM TERBIUM (III) FLUORIDE	5NAF.9TBF3	200
SODIUM THORIUM FLUORIDE	4NAF.THF4	201
SODIUM THORIUM FLUORIDE	7NAF.2THF4	202
BETA2 SODIUM THORIUM FLUORIDE	2NAF.THF4	203
DELTA SODIUM THORIUM FLUORIDE	2NAF.THF4	204
SODIUM THORIUM FLUORIDE	3NAF.2THF4	205
SODIUM THORIUM FLUORIDE	7NAF.6THF4	206
ALPHA SODIUM THORIUM FLUORIDE	NAF.THF4	207
BETA SODIUM THORIUM FLUORIDE	NAF.THF4	208
SODIUM THORIUM FLUORIDE	NAF.2THF4	209
BETA SODIUM THULIUM (III) FLUORIDE	NAF.TMF3	210
ALPHA SODIUM THULIUM (III) FLUORIDE	5NAF.9TMF3	211
SODIUM URANIUM (III) FLUORIDE	NAF.UF3	212
SODIUM URANIUM (IV) FLUORIDE	7NAF.2UF4	213
SODIUM URANIUM (IV) FLUORIDE	3NAF.UF4	214
DELTA SODIUM URANIUM (IV) FLUORIDE	2NAF.UF4	215
GAMMA SODIUM URANIUM (IV) FLUORIDE	2NAF.UF4	216
BETA-2 SODIUM URANIUM (IV) FLUORIDE	2NAF.UF4	217
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SODIUM URANIUM (IV) FLUORIDE	7NAF.6UF4	219
SODIUM URANIUM (IV) FLUORIDE	NAF.2UF4	220
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ALPHA SODIUM ZIRCONIUM FLUORIDE	5NAF.2ZRF4	228
BETA SODIUM ZIRCONIUM FLUORIDE	5NAF.2ZRF4	229
ALPHA SODIUM ZIRCONIUM FLUORIDE	2NAF.ZRF4	230
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YTTRIUM FLUORIDE	YF3	249
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ZIRCONIUM CHLORIDE	ZRCL4	251
ZIRCONIUM FLUORIDE	ZRF4	252
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ALUMINUM FLUORIDE ALF3

REFERENCES.
E.STARIZKY AND L.B.ASPREY,ANAL.CHEM.,28,(1956)

CRYSTAL SYSTEM. RHOMBOHEDRAL SPACE GROUP. R32
A#5.030 ALPHA#58.65 Z# 2 DENSITY#3.197

OPTICAL PROPERTIES.
N#1.376 VERY LOW BIREFRINGENCE .0001
COLORLESS UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.5200	110	-1	1.0593	420
2	2.5120	211	-1	1.0511	22-2
19	2.1190	210	1	1.0374	444
2	2.0740	222	-1	1.0096	400
1	2.0190	200	1	0.9856	532
24	1.7590	220	1	0.9338	41-1
2	1.6000	20-1	-1	0.8798	440
14	1.5870	321	-1	0.8703	554
7	1.5600	21-1	1	0.8577	541
1	1.4600	332	1	0.8495	510,43-1
2	1.4310	310	1	0.8380	633,552
2	1.4220	11-2	1	0.8285	530
1	1.3550	320	1	0.8229	33-2
3	1.2570	422	-1	0.8177	632
1	1.2330	20-2	-1	0.8100	622
1	1.2070	432	-1	0.8056	41-2
2	1.1950	433	-1	0.7997	40-2
1	1.1794	21-2	1	0.7933	642
1	1.1741	411,330	-1	0.7863	654
3	1.1631	30-1	-1	0.7806	42-2
1	1.1202	431	1	0.7785	653
1	1.0700	442		0.	

AMMONIUM BERYLLIUM FLUORIDE 2NH4F.BEF2

REFERENCES.
ASTM 3-0885,ORNL 2192

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#5.8 B#10.2 C#7.5 Z# 4 DENSITY#1.83

OPTICAL PROPERTIES.
N(AVERAGE)#1.319

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
13	5.2000	110,020	75	2.2700	113
63	4.3100	021	25	2.1600	
13	3.8300	130	25	2.1300	231,042
18	3.0800	031	20	2.0500	050
18	3.0100	112,022	8	2.0200	033
18	2.9600	200	8	1.9700	051
8	2.7200	131	20	1.9400	300
10	2.6600	122	10	1.9000	232,133,310
13	2.6100	211	10	1.8800	004
8	2.5700	040	10	1.8300	311
100	2.4800	003	13	1.8100	
63	2.4200	041,013	8	1.7800	223,043
13	2.3600	221	8	1.7500	321,114

BERYLLIUM FLUORIDE BEF2

REFERENCES.
ASTM 10-88

CRYSTAL SYSTEM. HEXAGONAL
A#4.74 C#5.18 Z# 3 DENSITY#2.324

OPTICAL PROPERTIES.
N#1.325 LOW BIREFRINGENCE EST.#.003
COLORLESS UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
70	4.0900	100	35	1.6060	202
100	3.2100	101	20	1.5910	103
100	2.3670	110	30	1.5500	210
100	2.1890	102	30	1.4840	211
100	2.1540	111	30	1.3200	203
70	1.9050	201	15	1.2330	104
50	1.7480	112	15	1.2080	302

COMMENTS.
LOW QUARTZ FORM

BERYLLIUM OXALATE HYDRATE BEC2O4.H2O

OPTICAL PROPERTIES.
CRYPTOCRYSTALLINE DEHYDATION PRODUCT OF BEC2O4.3H2O

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
70	6.9000	10	3.0000
20	5.9500	5	2.6150
100	3.9300	50	2.4550
20	3.7800	5	2.3750
10	3.4300	10	2.1900
20	3.0700	5	2.0300

COMMENTS.
PREPARED BY B.J.STURM FROM AQUEOUS SOLUTION

BERYLLIUM OXALATE HYDRATE BEC204.3H20

REFERENCES.
L.HAVESTADT,Z.ANORG.U.ALLGEM.CHEMIE 171,351 (1928)

OPTICAL PROPERTIES.
NX#1.428 NZ#1.552 BIAXIAL,2V#90

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
15	7.0400	25	3.0900
10	6.5200	65	2.8850
20	6.3100	25	2.6750
5	6.0300	15	2.6350
10	4.7700	20	2.4750
100	4.5900	20	2.4500
20	3.9800	25	2.4100
20	3.9100	10	2.3350
35	3.8050	20	2.3100
10	3.6400	5	2.2050
50	3.2200	5	2.1500
25	3.1600	5	1.9650

COMMENTS.
PREPARED BY B.J.STURM FROM AQUEOUS SOLUTION

BERYLLIUM OXIDE BEO

REFERENCES.
ASTM 4-0843
T.N.MCVAY ET AL, J.CERAM. SOC., 45,48 (1962)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P6MC
A#2.6979 C#4.380 Z# 2 DENSITY#3.008

OPTICAL PROPERTIES.
NO#1.719 NE#1.733 UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
91	2.3370	100	-1	1.0958	004
61	2.1890	002	3	1.0308	202
100	2.0610	101	-1	0.9920	104
22	1.5980	102	10	0.9118	203
29	1.3490	110	4	0.8832	210
24	1.2380	103	5	0.8657	211
4	1.1682	200	2	0.8498	114
16	1.1482	112	14	0.8199	105
5	1.1287	201	8	0.8179	212

COMMENTS.
THE OPTICAL INDICES OF BEO CHANGE WHEN IT IS EXPOSED TO
FAST NEUTRONS.
NE#1.700 NE#1.712 AFTER EXPOSURE TO 1.5 X 10 TO 21 POWER NVT.
BEO RECOVERS ITS NORMAL OPTICAL INDICES AFTER HEATING TO 1000 C.

CERIUM FLUORIDE CEF3

REFERENCES.
ASTM 8-45
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/MCM
A#7.112 C#7.279 Z# 6 DENSITY#6.157

OPTICAL PROPERTIES.
NO#1.613 NE#1.607 UNIAXIAL NEGATIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
40	3.6400	002	4	1.1854	330
34	3.5500	110	12	1.1755	404,413
100	3.1950	111	3	1.1480	116
12	2.5450	112	10	1.1268	225,332
4	2.2190	211	3	1.0810	414
44	2.0540	300	5	1.0443	306
52	2.0040	113	3	1.0264	600
5	1.8202	004	2	1.0021	226
30	1.7885	302	3	0.9981	117
18	1.7275	221	5	0.9932	334
4	1.6197	114	8	0.9877	415
3	1.5975	222	5	0.9774	521
12	1.4339	214,223	1	0.9520	522
9	1.3616	304	5	0.9136	523
8	1.3473	115	3	0.9005	416
6	1.3439	410	3	0.8976	227
14	1.3216	411	3	0.8942	604
2	1.2715	224	3	0.8825	441
2	1.2612	412	2	0.8670	524
2	1.2135	006	4	0.8478	336

BETA CESIUM BERYLLIUM FLUORIDE 2CSF.BEF2

REFERENCES.
ASTM 10-89
O.N.BREUSOV,A.V.NOVOSELOVA AND YU.P.SIMANOV,
DOKLADY AKAD. NAUK. SSSR 118,935 (1958).

OPTICAL PROPERTIES.
N#1.452 VERY LOW BIREFRINGENCE COLORLESS

THERMAL DATA.
ALPHA-BETA TRANSITION AT 404 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.3400	15	2.1640
25	4.4600	20	2.1060
15	4.0200	15	2.0790
15	3.8000	15	2.0250
60	3.6200	10	2.0000
30	3.4000	10	1.9590
10	3.2800	30	1.9010
100	3.2300	10	1.8220
80	3.0800	5	1.8050
10	2.8710	10	1.7700
10	2.6850	15	1.7240
35	2.6360	10	1.6730
20	2.5430	5	1.6200
20	2.3980	5	1.5840
15	2.3550	10	1.5410
20	2.2420		0.

GAMMA CESIUM BERYLLIUM FLUORIDE CSF.BEF2

REFERENCES.
ASTM 10-79
O.N.BREUSOV,A.V.NOVOSELOVA AND YU.P.SIMANOV,
DOKLADY AKAD. NAUK. SSSR 118,935 (1958).

OPTICAL PROPERTIES.
N#1.382 LOW BIREFRINGENCE,COLORLESS

THERMAL DATA.
BETA-GAMMA TRANSITION AT 140 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.9900	5	2.6670
50	5.4300	10	2.6620
5	4.2500	10	2.4130
10	3.9800	25	2.3670
35	3.8500	10	2.1840
30	3.6000	20	2.1300
35	3.5500	10	2.1150
85	3.4700	10	1.9750
10	3.3100	5	1.9280
100	3.2000	15	1.8120
40	3.0000	10	1.7790
10	2.8220	10	1.5990

CESIUM LANTHANUM FLUORIDE 3CSF.LAF3

REFERENCES.
ASTM 10-87
E.P.DERGUNOV, AKAD. NAUK. SSSR, 60,1185 (1948).

OPTICAL PROPERTIES.
N#1.462

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	3.4900	20	1.7510
35	2.4780	12	1.5690
60	2.0210		0.

CESIUM MAGNESIUM FLUORIDE CSF.MGF2

REFERENCES.
W.L.W.LUDEHEUS AND A.J.E.WELCH, ACTA. CRYST.5, 841 (1952).

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. P2221
A#3.076 B#7.305 C#13.35

OPTICAL PROPERTIES.
NX#1.454 NZ#1.462 BIAXIAL POSITIVE,2V#50

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
5	6.4100	011	10	2.4930	015
5	4.9300	012	5	2.4630	024
5	3.8000	013	10	2.4310	030
15	3.6500	020	10	2.3930	031
15	3.5200	021	15	2.3510	120
100	3.3300	004	10	2.3130	121
5	3.2000	022	35	2.2830	104
20	3.0750	100	10	2.2320	006
5	3.0300	014	50	2.1550	025
5	2.8200	023	5	2.1270	016
10	2.7680	111	5	1.9670	034

CESIUM THORIUM FLUORIDE 3CSF.THF4

REFERENCES.
R.E.THOMA AND T.S.CARLTON, J.OF INORG. AND NUCL. CHEM.17,88(1961)

CRYSTAL SYSTEM. CUBIC
A#10.04

OPTICAL PROPERTIES.
N#1.464

THERMAL DATA.
MELTS CONGRUENTLY AT 980 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.5610	220	10	1.7760	440
20	2.5130	400	15	1.5880	620
30	2.0490	422		0.	

CESIUM THORIUM FLUORIDE 2CSF.THF4

REFERENCES.
ASTM 13-234
R.E.THOMA AND T.S.CARLTON, J.OF INORG. AND NUCL. CHEM.17,88(1961)

OPTICAL PROPERTIES.
NX#1.500 NZ#1.506 BIAXIAL,HIGHLY TWINNED

THERMAL DATA.
MELTS CONGRUENTLY AT 869 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
30	6.3200	10	2.0340
5	4.9700	5	1.9750
5	4.0600	5	1.9470
100	3.6700	5	1.9050
20	3.3400	10	1.8290
5	3.1700	5	1.7790
5	2.9570	10	1.7570
5	2.9100	10	1.7250
5	2.4670	5	1.5960
10	2.3960	5	1.5490
5	2.3420	5	1.4890
15	2.2850	5	1.4490
60	2.1120	5	1.4310

CESIUM THORIUM FLUORIDE CSF.THF4

REFERENCES.
ASTM 13-543
R.E.THOMA AND T.S.CARLTON, J.OF INORG. AND NUCL. CHEM.17,88(1961)

OPTICAL PROPERTIES.
NX#1.528 NZ#1.544 BIAXIAL NEGATIVE,2V#20
HIGHLY TWINNED

THERMAL DATA.
MELTS CONGRUENTLY AT 839 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
55	7.3700	5	2.4340
5	4.5300	10	2.2630
5	4.0600	20	2.1060
60	3.7000	10	2.0560
100	3.6700	15	2.0260
85	3.5600	10	1.8290
10	3.3100	10	1.7760
5	3.1100	10	1.7570
5	2.9190	5	1.5500
10	2.8680		0.

CESIUM THORIUM FLUORIDE 2CSF.3THF4

REFERENCES.
ASTM 13-556
R.E.THOMA AND T.S.CARLTON, J.OF INORG. AND NUCL. CHEM.17,88(1961)

OPTICAL PROPERTIES.
NX#1.518 NZ#1.526 BIAXIAL POSITIVE,2V#15

THERMAL DATA.
MELTS INCONGRUENTLY TO CSF.2THF4 AND
LIQUID AT 842 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	7.3100	5	2.3020
15	6.1500	5	2.1570
5	4.3100	5	2.1200
5	4.0800	5	2.0970
100	3.7000	5	2.0380
5	3.2300	5	1.8540
5	2.9600	15	1.8430
5	2.9380		0.

CESIUM THORIUM FLUORIDE CSF.2THF4

REFERENCES.
ASTM 13-377
R.E.THOMA AND T.S.CARLTON, J.OF INORG. AND NUCL. CHEM.17,88(1961)

OPTICAL PROPERTIES.
NO#1.532 NE#1.524 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO CSF.6THF4 AND
LIQUID AT 860 C.
METASTABLE BELOW 813 C WITH RESPECT TO 2CSF.3THF4 AND CSF.3THF4

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
20	5.6600	5	2.8030
45	3.8500	25	2.2520
100	3.7600	15	2.0690
20	2.9860	45	1.8400

CESIUM THORIUM FLUORIDE CSF.3THF4

REFERENCES.
ASTM 13-252
R.E.THOMA AND T.S.CARLTON, J.OF INORG. AND NUCL. CHEM.17,88(1961)

OPTICAL PROPERTIES.
NX#1.544 NZ#1.558 BIAXIAL POSITIVE,2V#35

THERMAL DATA.
SUBSOLIDUS COMPOUND. UNSTABLE ABOVE 830 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
25	8.1800	10	2.4660
20	7.3400	10	2.2160
25	4.6900	20	2.1490
20	4.3300	50	2.0880
15	4.1000	30	2.0740
35	3.8300	55	2.0470
50	3.7600	55	2.0000
100	3.6100	10	1.9280
90	3.4800	15	1.9100
35	3.4200	35	1.8970
75	3.3400	15	1.8500
35	3.2100	25	1.7630
45	2.9800	20	1.7460
15	2.7690	10	1.6270
20	2.6960	10	1.5600
10	2.6490		0.

CESIUM THORIUM FLUORIDE CSF.6THF4

REFERENCES.
ASTM 13-412
R.E.THOMA AND T.S.CARLTON, J.OF INORG. AND NUCL. CHEM.17,88(1961)

CRYSTAL SYSTEM. HEXAGONAL
A#8.31 C#16.91

OPTICAL PROPERTIES.
NO#1.540 NE#1.534 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO THF4 AND LIQUID AT 1010 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	7.2500	100	5	2.4050	300
10	4.4500	103	5	2.3360	116
100	4.2300	004	55	2.1110	008
60	3.5900	200	60	2.0870	117
45	3.5400	201	25	2.0740	220
10	3.3600	113	10	2.0040	207
10	3.0400	203	10	1.9390	132
20	2.9710	114	30	1.8680	224
15	2.8160	006	10	1.7990	400

COMMENTS.
LATTICE CONSTANTS REFINED BY LEAST SQUARES FIT OF POWDER DATA

CESIUM URANIUM (IV) FLUORIDE 3CSF.UF4

REFERENCES.
ORNL-2548 P92

OPTICAL PROPERTIES.
N#1.478 PALE BLUE

THERMAL DATA.
MELTS CONGRUENTLY AT 970 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	6.9200	70	3.2200
15	5.5000	20	3.0100
35	4.1700	40	2.1470
70	3.8150	45	2.0740
100	3.5000	25	2.0360
20	3.4550	25	1.8260

COMMENTS.
XRAY DATA FROM CRYSTALS GROWN FROM H2O SOLUTION

CESIUM URANIUM (IV) FLUORIDE 2CSF.UF4

REFERENCES.
ASTM 10-78, ORNL-2548 P92

OPTICAL PROPERTIES.
NX#1.516 NZ#1.524 BIAXIAL NEGATIVE,2V#45
X#LIGHT GREENISH BLUE,Z#LIGHT BLUE

THERMAL DATA.
MELTS INCONGRUENTLY TO 3CSF.UF4 AND LIQUID AT 800 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
15	6.9200	20	2.8140
50	6.1900	15	2.7310
15	4.9000	10	2.6520
10	4.0400	20	2.4750
10	3.9800	20	2.4530
35	3.9300	15	2.2860
25	3.8000	10	2.2260
35	3.6500	20	2.1010
45	3.5900	40	2.0600
100	3.5500	55	2.0340
100	3.4400	10	1.9550
15	3.3100	5	1.8150
15	3.2900	20	1.7760
15	3.0900	20	1.7700
10	3.0000	10	1.7080
5	2.9300	5	1.6400
10	2.8900	10	1.6010

CESIUM URANIUM (IV) FLUORIDE CSF.UF4

REFERENCES.
ASTM 10-77, ORNL-2548 P92

OPTICAL PROPERTIES.
NX#1.553 NZ#1.560 BIAXIAL POSITIVE,2V#45
Z#SKY BLUE,X#GREENISH BLUE,POLYSYNTHETIC TWINNING
ANGLE X-C#10

THERMAL DATA.
MELTS CONGRUENTLY AT 735 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
45	8.0400	35	2.4100
70	7.3100	10	2.2920
20	5.8000	10	2.2440
10	5.3000	10	2.1890
5	5.1300	5	2.1110
10	4.4800	35	2.0690
5	4.3500	25	2.0250
20	4.1500	30	2.0000
80	4.0000	10	1.9160
15	3.7800	5	1.8900
100	3.6200	60	1.8050
70	3.5500	5	1.7570
20	3.2500	5	1.6790
10	3.1700	10	1.6540
40	2.8750	10	1.6090
10	2.8220	5	1.5380
5	2.7390	5	1.5320
20	2.6600	5	1.5200
5	2.6150	5	1.4850

CESIUM URANIUM (IV) FLUORIDE 2CSF.3UF4

CRYSTAL SYSTEM. MONOCLINIC SPACE GROUP. P21/M OR P21
A#8.39 B#8.46 C#20.88 BETA#119.89

OPTICAL PROPERTIES.
NX#1.560 NZ#1.570 BIAXIAL POSITIVE,2V#70,GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO CSF.6UF4 AND LIQUID AT 737 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
5	9.0500	002	5	2.7330	220
20	6.0600	003	5	2.3780	222,22-7
15	4.2400	020	5	2.2960	32-2
15	3.8300	022	15	2.1990	027
100	3.6400	200,005	10	2.1160	040
100	3.6400	20-5	15	2.0880	20-10,205
100	3.5670	12-3	10	2.0610	042
20	3.4710	023	10	1.9950	028
5	3.3860	121	5	1.8720	22-10
10	3.3310	210	20	1.8230	400,045
5	3.2710	12-4	5	1.7890	42-8
5	3.0870	024	5	1.5890	146
15	2.9430	22-3	10	1.4900	245,44-5

CESIUM URANIUM (IV) FLUORIDE CSF.6UF4

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P6/MMC
A#8.192 C#16.63 Z# 2 DENSITY#6.989

OPTICAL PROPERTIES.
NO#1.598 NE#1.590 UNIAXIAL NEGATIVE,DEEP GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO UF4 AND LIQUID AT 867 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	8.3400	002	40	2.0720	008
15	7.1900	100	75	2.0520	034
20	6.6000	101	60	1.9710	207
65	4.3800	103	10	1.9090	312
100	4.1600	004	10	1.8570	118
50	3.5700	104	30	1.8380	224
100	3.4800	201	10	1.7890	109
50	3.0000	105	10	1.7750	400
30	2.9190	114	25	1.7670	401
20	2.7610	006	15	1.6910	135
20	2.7010	204	10	1.6430	209
25	2.4210	025	10	1.6320	044
10	2.2470	124		0.	

CESIUM ZIRCONIUM FLUORIDE 3CSF.ZRF4

REFERENCES.
J.H.BURNS AND G.D.ROBBINS ORNL-3417, ORNL-2548 P58
G.D.ROBBINS, R.E.THOMA AND H.INSLEY, J.INORG. NUCL.CHEM.(IN PRESS)

CRYSTAL SYSTEM. CUBIC SPACE GROUP. F43M,F432 OR FM3M
A#9.70 Z# 4 DENSITY#4.53

OPTICAL PROPERTIES.
N#1.471

THERMAL DATA.
MELTS CONGRUENTLY AT 784 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
VS	3.4300	220	S	1.9800	422
VW	2.9200	311	M	1.7150	440
VW	2.8030	222	MS	1.5350	620
S	2.4240	400	MS	1.2970	642

BETA CESIUM ZIRCONIUM FLUORIDE 2CSF.ZRF4

REFERENCES.
ASTM 10-86,ORNL 2548
V.BODE AND G.TEUFER,Z.ANORG.ALLGEM.CHEM.,283,18,(1956)
G.D.ROBBINS,R.E.THOMA AND H.INSLEY,J.INORG.NUCL.CHEM. (IN PRESS)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-3M1
A#6.41 C#5.01 Z# 1 DENSITY#4.386

OPTICAL PROPERTIES.
NO#1.482 NE#1.460 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO 3CSF.ZRF4 AND LIQUID AT 530 C.

XRAY DATA.

I/I CAL	D-CAL	HKL	I/I CAL	D-CAL	HKL
10	5.5510	100	10	1.6025	220
5	5.0100	001	10	1.4810	113
100	3.7190	101	10	1.4717	131
70	3.2050	110	5	1.3374	401
5	2.6990	111	10	1.3117	312
30	2.4280	021	5	1.2398	033
25	2.2830	012	5	1.2343	231
30	1.9350	211	5	1.2114	410
15	1.8596	202	5	1.0268	241
15	1.8504	300	5	0.9806	143
5	1.6700	003	5	0.9778	511
15	1.6085	122		0.	

COMMENTS.
SYNTHETIC POWDER PATTERN CALCULATED FROM STRUCTURE

ALPHA CESIUM ZIRCONIUM FLUORIDE CSF.ZRF4

REFERENCES.
G.D.ROBBINS,R.E.THOMA AND H.INSLEY,J.INORG.NUCL.CHEM. (IN PRESS)

OPTICAL PROPERTIES.
NX#1.464 NZ#1.476 BIAXIAL POSITIVE,2V#75

THERMAL DATA.
INVERTS TO BETA CSF.ZRF4 BELOW 330 C.
MELTS CONGRUENTLY AT 518 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
M	5.8000	S	3.7800
M	4.5900	M	3.6800
VS	3.8800		0.

BETA CESIUM ZIRCONIUM FLUORIDE CSF.ZRF4

REFERENCES.
ORNL-2548
G.D.ROBBINS,R.E.THOMA AND H.INSLEY,J.INORG.NUCL.CHEM. (IN PRESS)

OPTICAL PROPERTIES.
NO#1.476 NE#1.464 UNIAXIAL NEGATIVE
OCCASIONALLY BIAXIAL NEGATIVE WITH VARIABLE 2V.

THERMAL DATA.
INVERTS TO ALPHA CSF.ZRF4 ABOVE 330 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
S	6.6500	VW	2.6800
W	6.1500	VW	2.5720
+W	4.3300	+W	2.5130
W	4.2700	W	2.3200
+W	3.9800	W	2.2580
-M	3.8800	W	2.2470
-M	3.8100	W	2.2100
VS	3.7000	W	2.1790
S	3.5900	W	2.1590
+W	3.5000	W	2.0740
+M	3.4200	W	2.0000
VS	3.2300	W	1.8500
+W	3.1500	VW	1.7380
M	3.0970	VW	1.4660
VW	2.9960		0.

CHROMIUM (II) FLUORIDE CRF2

REFERENCES.
ASTM 11-84
ORNL 2192
K.H.JACK AND R.MAITLAND, PROC.CHEM.SOC.,232,(1957)

OPTICAL PROPERTIES.
NX#1.511 NZ#1.525 BIAXIAL POSITIVE,2V#10
GRAY GREEN,ANGLE X-C#38 DEGREES

THERMAL DATA.
MELTS CONGRUENTLY AT 894 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
20	3.6900	10	2.3550
5	3.5600	5	2.3220
50	3.3500	10	2.0740
25	3.2800	15	1.8840
10	3.1000	10	1.8430
100	2.9700	15	1.7630
30	2.8050	10	1.7430
5	2.6600	10	1.6650
15	2.5080	10	1.5940
10	2.3980		0.

CHROMIUM (III) FLUORIDE CRF3

REFERENCES.
ASTM 10-85
ORNL 2192

OPTICAL PROPERTIES.
NO#1.568 NE#1.582 UNIAXIAL POSITIVE,GREEN

THERMAL DATA.
MELTS CONGRUENTLY AT 1404 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.4300	25	2.1690
30	4.0000	5	2.0040
100	3.6200	10	1.8290
5	2.9100	20	1.8090
5	2.8850	30	1.6490
25	2.6220	5	1.6220
10	2.5010	10	1.5860
10	2.4100		0.

CHROMIUM (II) CHROMIUM (III) FLUORIDE CRF2.CRF3

REFERENCES.
B.J. STURM,INORG. CHEM.1,665 (1962)
H. STEINFINK AND J.H.BURNS,ACTA. CRYST. 17,823,(1964)

CRYSTAL SYSTEM. MONOCLINIC SPACE GROUP. C2/C
A#7.773 B#7.540 C#7.440 Z# 4
BETA#124.25 DENSITY# 3.584

OPTICAL PROPERTIES.
NX#1.518 NZ#1.534 BIAXIAL NEGATIVE,2V#55

THERMAL DATA.
MELTS INCONGRUENTLY AT 997 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.7600	020	15	2.3500	
100	3.3600	20-2	15	1.8850	040
25	3.2100	200	15	1.8550	20-4
10	3.0800	002	20	1.7800	202,31-4
45	2.5050	22-2	15	1.6600	22-4
35	2.4450	220	15	1.6200	240
15	2.4200	31-2	25	1.6100	222,042,400

COPPER (II) URANIUM (VI) OXIDE CUO.3UO3

REFERENCES.
J.S.GILL AND W.L.MARSHALL, J.INORG.NUCL.CHEM.,20,85,(1961)

THERMAL DATA.
STABLE TO 830 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	5.1200	15	1.7090
15	4.7200	20	1.6350
60	4.1700	5	1.6200
100	3.2600	5	1.5770
60	3.2400	5	1.5490
10	2.9400	5	1.5180
30	2.5630	5	1.3920
15	2.0850	5	1.3580
10	2.0620	5	1.2830
10	1.9720	5	1.2760
15	1.8910	10	1.2350
30	1.8770	10	1.2310
10	1.7580		0.

DYSPROSIUM (III) FLUORIDE DYF3

REFERENCES.
ASTM 5-0400
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.460 B#6.906 C#4.376 Z# 4 DENSITY#7.465

OPTICAL PROPERTIES.
NX#1.570 NZ#1.600 BIAXIAL NEGATIVE,2V#85

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	3.6900	011	50	1.5000	312
100	3.6200	101	60	1.4800	331,411
100	3.4700	020	50	1.4600	420
100	3.2200	111	20	1.4400	241
50	2.9300	210	50	1.4200	013,232
5	2.5900	201	5	1.4000	322
50	2.5100	121	5	1.3900	113
5	2.4300	211	50	1.3500	042
50	2.1900	002	50	1.3300	203,142
50	2.0700	221	20	1.3200	123,051
60	1.9800	112	20	1.3000	402
100	1.9400	131	40	1.2900	151
50	1.9300	301	50	1.2900	341
90	1.8700	230	20	1.2800	332,412
50	1.8600	311	100	1.2700	250
50	1.8500	022	100	1.2400	223
50	1.7700	122	20	1.2300	033
50	1.7500	212	50	1.2200	511
50	1.7200	040	20	1.2100	422
50	1.6900	321	5	1.1900	313
40	1.6100	400	50	1.1800	440
50	1.5600	141	50	1.1700	521
40	1.5400	132		0.	

ERBIUM (III) FLUORIDE ERF3

REFERENCES.
ASTM 5-0541
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.354 B#6.846 C#4.380 Z# 4 DENSITY#7.814

OPTICAL PROPERTIES.
NX#1.566 NZ#1.598 BIAXIAL NEGATIVE,2V#80

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
40	3.6900	011	60	1.4600	331
60	3.6100	101	5	1.4600	411
90	3.4200	020	30	1.4400	420
100	3.1900	111	50	1.4300	013
100	2.8800	210	60	1.4100	232
10	2.5700	201	50	1.3900	113,322
50	2.4800	121	50	1.3500	042
5	2.4100	211	50	1.3300	203
40	2.1900	002	30	1.3200	142
30	2.0500	221	5	1.3100	123
50	1.9800	112	20	1.3000	430,213
90	1.9300	131	20	1.2900	402
60	1.9100	301	50	1.2800	151
90	1.8500	230	100	1.2700	341
20	1.8400	311	5	1.2600	332
40	1.7700	122	50	1.2600	250
90	1.7400	212	20	1.2500	431
50	1.7100	040	100	1.2400	223
60	1.6600	321	40	1.2300	033
50	1.5900	400	20	1.2200	501
50	1.5500	141	50	1.2000	511
20	1.5300	132	90	1.2000	422
5	1.5200	302	10	1.1800	313
50	1.4900	312	100	1.1600	440

EUROPIUM (II) FLUORIDE EUF2

REFERENCES.
ASTM 12-391

CRYSTAL SYSTEM. CUBIC
A#5.836

OPTICAL PROPERTIES.
N#1.551

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.3700	111	40	1.3030	420
60	2.9150	200	60	1.1905	422
90	2.0600	220	60	1.1225	511,333
80	1.7580	311	60	1.0315	440
40	1.6830	222	80	0.9865	531
40	1.4600	400	60	0.9726	600,442
60	1.3400	331		0.	

EUROPIUM (III) FLUORIDE EUF3

REFERENCES.
ASTM 5-0535
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.622 B#7.019 C#4.396 Z# 4 DENSITY#6.793

OPTICAL PROPERTIES.
NX#1.572 NZ#1.600 BIAXIAL POSITIVE,2V#85

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
20	3.7100	011	20	1.5600	132
60	3.6600	101	50	1.5200	312
50	3.5600	020	20	1.5100	411,331
100	3.2400	111	40	1.5000	420
90	2.9900	210	5	1.4600	241
40	2.5300	121	50	1.4400	232
40	2.2000	002	40	1.4300	013
50	2.1100	221	10	1.4200	322
50	2.0000	112	20	1.3700	042
100	1.9600	301,131	30	1.3400	203
60	1.9100	230	20	1.3200	402
40	1.9000	311	90	1.3100	241
30	1.8600	022	40	1.2900	250
50	1.7900	122	100	1.2500	223
40	1.7700	212	40	1.2400	422
40	1.7500	040	50	1.2000	440
50	1.7200	321	50	1.1900	521
40	1.6600	400	60	1.1700	060
40	1.5800	141	90	1.1600	152

GADOLINIUM (III) FLUORIDE GDF3

REFERENCES.
ASTM 12-788
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.571 B#6.985 C#4.393 Z# 4 DENSITY#7.056

OPTICAL PROPERTIES.
NX#1.570 NZ#1.600 BIAXIAL NEGATIVE,2V#85

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
30	3.7200	011	16	1.7094	321
55	3.6500	101	6	1.6423	400
60	3.4940	020	6	1.5756	141
100	3.2360	111	6	1.5514	132,302
60	2.9740	210	8	1.5137	312
4	2.6330	201	10	1.5025	411
18	2.5230	121	12	1.4997	331
4	2.4610	211	6	1.4869	420
2	2.3930	220	6	1.4553	241
12	2.1950	002	12	1.4362	232
18	2.1020	221	10	1.4329	013
4	2.0830	102	-1	1.4295	103
25	1.9959	112	2	1.4170	322
65	1.9615	131,301	-1	1.4079	421
35	1.8993	230	4	1.4000	113
18	1.8876	311	6	1.3669	042
12	1.8590	022	6	1.3427	430
18	1.7881	122	8	1.3375	142,203
18	1.7662	212	4	1.3315	051
12	1.7455	040		0.	

HOLMIUM (III) FLUORIDE HOF3

REFERENCES.
ASTM 5-0725
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.404 B#6.875 C#4.379 Z# 4 DENSITY#7.644

OPTICAL PROPERTIES.
NX#1.566 NZ#1.598 BIAXIAL NEGATIVE,2V#90

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
25	3.6900	011	40	1.4900	312
50	3.5700	101	40	1.4700	331,411
60	3.4300	020	25	1.4500	420
90	3.1900	111	20	1.4300	013,241
50	2.9000	210	40	1.4200	232
5	2.5800	201	20	1.3900	113,322
50	2.4900	121	90	1.3700	421
20	2.4000	211	40	1.3500	042
20	2.1800	002	15	1.3200	203
40	2.0600	221	15	1.3200	142
20	1.9800	112	20	1.3100	430
50	1.9300	131	100	1.2900	402
100	1.9200	301	40	1.2800	151
50	1.8600	230,022	50	1.2800	341
50	1.8400	311	20	1.2600	250
20	1.7700	122	100	1.2400	223
60	1.6700	321	5	1.2300	501
15	1.6000	400	100	1.2100	422,511
25	1.5500	141	25	1.1700	440
20	1.5300	132	40	1.1500	521

INDIUM FLUORIDE INF3

REFERENCES.
J.H.BURNS AND G.D.ROBBINS, ORNL-3417,P12

CRYSTAL SYSTEM. RHOMBOHEDRAL
A#5.73 ALPHA#56 40

OPTICAL PROPERTIES.
NO#1.442 NE#1.452 UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
5	4.1200	100	5	1.1760	11-3
100	3.9000	110	5	1.1540	22-2
30	2.8400	112	5	1.1160	235
20	2.6900	1-10	5	1.0960	354
5	2.3900	222	5	1.0610	13-2
5	2.3480	120,11-1	5	1.0520	254
10	2.2200	200	5	1.0280	12-3
20	1.9570	220	5	1.0210	115
25	1.7890	123	5	1.0040	2-23,455
5	1.7520	1-20	5	0.9811	440
15	1.7140	1-12	5	0.9641	145
5	1.6770	233	5	0.9508	555
10	1.5850	333	5	0.9394	346,11-4
10	1.5580	313	5	0.9285	350
5	1.4260	224	5	0.9218	236
5	1.3740	334	5	0.9090	33-2
5	1.3500	2-20	5	0.9005	456
5	1.3070	13-1	5	0.8980	246
5	1.2770	3-10	5	0.8890	14-2,356
5	1.2610	134	5	0.8777	155
5	1.2210	244	5	0.8607	136
5	1.1980	444	5	0.8435	256

IRON (II) FLUORIDE FEF2

REFERENCES.
ORNL 2192

OPTICAL PROPERTIES.
NO#1.524 NE#1.540 UNIAXIAL POSITIVE,BROWN

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	3.6500	5	1.9500
100	3.3200	60	1.7700
5	2.9700	25	1.6600
60	2.7000	15	1.4800
40	2.3400	20	1.4100
15	2.1000		0.

IRON (II) ZIRCONIUM FLUORIDE FEF2.ZRF4

REFERENCES.
ASTM 9-18

CRYSTAL SYSTEM. CUBIC
A#8.072

OPTICAL PROPERTIES.
N#1.432

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	4.6500	111	50	2.0180	400
100	4.0300	200	65	1.8040	420
45	2.8500	220	10	1.4270	440
7	2.4290	311	15	1.3460	600,442

LANTHANUM FLUORIDE LAF3

REFERENCES.
E.STARIZKY AND L.B.ASPREY, ANAL.CHEM.29,857,(1957)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/MCM
A#7.186 C#7.352 Z# 6 DENSITY#5.936

OPTICAL PROPERTIES.
NO#1.603 NE#1.597 UNIAXIAL NEGATIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	3.6600	002	5	1.6100	222
15	3.5800	110	30	1.4460	223
95	3.2100	111	25	1.3740	304
10	2.5620	112	15	1.3580	115
5	2.2360	121	30	1.3340	411
65	2.0700	300	5	1.2830	224
100	2.0200	113	10	1.2730	412
15	1.8340	004	10	1.2240	006
50	1.8030	302	15	1.1970	330
35	1.7410	221	30	1.1870	413
10	1.6320	114	10	1.1590	116

LITHIUM ALUMINUM FLUORIDE 3LIF.ALF3

OPTICAL PROPERTIES.
NX#1.366 NZ#1.386 BIAXIAL NEGATIVE,2V#80

THERMAL DATA.
MELTS CONGRUENTLY AT 795 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	6.2600	5	1.9120
5	4.5800	5	1.7630
55	4.2000	15	1.7030
100	4.1300	40	1.6900
5	3.8400	10	1.5740
20	3.4100	15	1.5580
25	2.6260	5	1.4680
5	2.4400	5	1.4420
5	2.4020	5	1.4180
15	2.3840	15	1.4000
5	2.3220	15	1.3740
65	2.1720	5	1.3140
90	2.1390	5	1.1600
5	2.0610		0.

LITHIUM BERYLLIUM FLUORIDE 2LIF.BEF2

REFERENCES.
ASTM 6-0557, ORNL-2548,P33

CRYSTAL SYSTEM. RHOMBOHEDRAL SPACE GROUP. R-3
A#13.27 ALPHA#8.89 Z# 18 DENSITY#2.1953

OPTICAL PROPERTIES.
NO#1.312 NE#1.319 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO LIF AND LIQUID AT 454 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
30	6.6600	110	5	2.0120	511
15	4.1500	012	5	1.9510	422
60	3.9000	211	40	1.9180	060
60	3.8300	030	30	1.8430	520
95	3.3200	220	10	1.7760	333
25	3.1100	122	10	1.7420	342
10	3.0100	131	10	1.7200	161
90	2.7150	113	5	1.7030	324
10	2.6000	312	10	1.6490	125
100	2.5080	140	55	1.6100	603
10	2.4490	123	10	1.5720	621
100	2.3500	033	15	1.5550	253
100	2.2120	330	5	1.5240	710
10	2.0430	502	40	1.3560	713

COMMENTS.
INDEXED AS HEXAGONAL

LITHIUM BERYLLIUM FLUORIDE LIF.BEF2

REFERENCES.
ORNL-2548 P33

OPTICAL PROPERTIES.
NX#1.357 NY# NZ#1.363 BIAXIAL POSITIVE,2V#30
HIGHLY TWINNED

THERMAL DATA.
UNSTABLE ABOVE 280 C WITH RESPECT TO 2LIF.BEF2 AND BEF2.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	4.7500	35	2.7800
5	4.3900	35	2.7310
35	4.2900	25	2.5080
5	4.1300	40	2.4560
5	3.9000	40	2.4360
10	3.5300	10	2.3850
10	3.4300	10	2.3440
10	3.3100	85	2.2640
35	3.1800	100	2.2010
5	3.1300	40	2.1540
45	3.0800	5	2.1350
5	3.0300	15	2.0740
20	2.9100	20	2.0560
10	2.8230		0.

LITHIUM BERYLLIUM ZIRCONIUM FLUORIDE 6LIF.BEF2.ZRF4

REFERENCES.
D.R.SEARS AND J.H.BURNS,J.CHEM.PHYS. (IN PRESS)

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/AMD
A#6.58 C#18.61 Z# 4 DENSITY#3.06

OPTICAL PROPERTIES.
NO#1.418 NE#1.414 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS SEMICONGRUENTLY AT 474 C TO LIF AND LIQUID.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	6.1900	101	10	1.8970	208
100	4.6300	004	10	1.8160	321
100	4.5000	103	15	1.7480	323
100	4.1500	112	35	1.7260	316
50	3.2880	200	10	1.6910	219,307
15	3.2350	105	65	1.6430	228,400
15	2.9000	211	5	1.5890	411
100	2.6800	204	10	1.5500	00.12,404
25	2.5760	116	15	1.5030	309,327
10	2.3130	008,220	15	1.4660	420,21.11
50	2.3050	215	10	1.4010	20.12,424
50	2.2580	206	10	1.3860	31.10,336
15	2.1770	301	5	1.3120	426
45	2.0670	224,303	10	1.2860	22.12,21.13
25	2.0280	312	10	1.2780	11.14,512
70	1.9710	109,217	5	1.2400	

LITHIUM CHROMIUM (III) FLUORIDE 3LIF.CRF3

REFERENCES.
ASTM 10-80

OPTICAL PROPERTIES.
NX#1.444 NZ#1.464 BIAXIAL NEGATIVE,2V#40

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
45	4.2900	25	2.1400
100	4.1600	20	2.0920
35	3.4500	10	2.0080
30	2.6700	10	1.7360
25	2.2120	25	1.7300
80	2.1760	35	1.7120

LITHIUM DYSPROSIUM (III) FLUORIDE LIF.DYF3

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.19 C#10.81 Z# 4 DENSITY#5.06

OPTICAL PROPERTIES.
NO#1.476 NE#1.504 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO DYF3 AND LIQUID AT 811 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.6900	101	5	1.7080	301
70	3.0500	112	10	1.6200	116
10	2.9700	103	20	1.5670	312
10	2.7000	004	10	1.5620	303
5	2.6000	200	5	1.5180	224
30	2.2630	211	5	1.4810	107
10	2.1790	114	10	1.4260	321
5	2.0000	105	5	1.3510	008
25	1.9510	213	5	1.3380	323
20	1.8750	204	5	1.2980	400
10	1.8360	220		0.	

LITHIUM ERBIUM (III) FLUORIDE LIF.ERF3

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.16 C#10.70 Z# 4 DENSITY#5.84

OPTICAL PROPERTIES.
NO#1.474 NE#1.502 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 815 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.6400	101	30	1.8540	204
50	3.0000	112	15	1.8260	220
20	2.9300	103	5	1.7260	222
5	2.6700	004	10	1.6970	301
15	2.5800	200	25	1.6040	116
40	2.2520	211	30	1.5690	215
10	2.1540	114	40	1.5590	312
25	2.0170	105	15	1.5500	303
35	1.9360	213		0.	

LITHIUM EUROPIUM (III) FLUORIDE LIF.EUF3

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.21 C#11.02 Z# 4 DENSITY#4.05

OPTICAL PROPERTIES.
NO#1.477 NE#1.510 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY AT 681 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.7400	101	25	1.9750	213
70	3.0800	112	25	1.8970	204
20	3.0100	103	20	1.8470	220
10	2.7600	004	15	1.7380	222
10	2.6050	200	10	1.5840	132
5	2.3190	202	5	1.5670	303
30	2.2850	211	5	1.5380	224
5	2.1840	114	10	1.4420	231
25	2.0390	105		0.	

LITHIUM GADOLINIUM (III) FLUORIDE LIF.GDF3

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.21 C#11.00 Z# 4 DENSITY#5.37

OPTICAL PROPERTIES.
NO#1.474 NE#1.502 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO GDF3 AND LIQUID AT 748 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.7200	101	5	2.0260	105
60	3.0700	112	25	1.9670	213
20	3.0000	103	15	1.8860	204
5	2.7400	004	10	1.8430	220
10	2.6050	200	10	1.6380	116
30	2.2850	211	10	1.5790	312
5	2.1790	114	10	1.5720	303

LITHIUM HOLMIUM (III) FLUORIDE LIF.HOF3

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.16 C#10.75 Z# 4 DENSITY#5.74

OPTICAL PROPERTIES.
NO#1.472 NE#1.498 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTY TO HOF3 + LIQUID AT 788 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.6400	101	30	1.9430	213
90	3.0200	112	50	1.8650	204
20	2.9500	103	20	1.8260	220
5	2.6800	004	10	1.7030	301
10	2.5800	200	5	1.6090	116
5	2.2580	211	5	1.5740	215
5	2.1690	114	15	1.5590	312
10	1.9880	105	15	1.5520	303

LITHIUM LUTETIUM (III) FLUORIDE LIF.LUF3

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.13 C#10.55 Z# 4 DENSITY#6.18

OPTICAL PROPERTIES.
NO#1.468 NE#1.494 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 800 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.6200	101	25	1.8400	204
70	2.9900	112	20	1.8060	220
30	2.9000	103	10	1.6850	301
10	2.6300	004	10	1.5810	116
15	2.5600	200	15	1.5520	312
50	2.2410	211	25	1.5370	303
10	2.1350	114	20	1.3170	008
25	1.9510	105	30	1.2570	400
30	1.9200	213		0.	

LITHIUM TERBIUM (III) FLUORIDE LIF.TBF3

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.19 C#10.89 Z# 4 DENSITY#5.48

OPTICAL PROPERTIES.
NO#1.476 NE#1.502 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO TBF3 AND LIQUID AT 787 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.7200	101	5	1.7080	301
70	3.0500	112	5	1.7080	301
30	2.9800	103	10	1.6250	116
70	2.2740	211	10	1.6250	116
10	2.0090	105	10	1.5720	312
20	1.9590	213	10	1.5720	312
15	1.8830	204	10	1.5620	303
15	1.8290	220		0.	

LITHIUM THORIUM FLUORIDE 3LIF.THF4

REFERENCES.
ASTM 12-557
L.A.HARRIS,G.D.WHITE AND R.E.THOMA, J.PHYS.CHEM.,63,1974,(1959)

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. P4/NMM
A#6.206 C#6.470 Z# 2 DENSITY#5.143

OPTICAL PROPERTIES.
NX#1.480 NZ#1.488 BIAXIAL NEGATIVE,2V#10

THERMAL DATA.
MELTS CONGRUENTLY AT 563 .

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	6.4200	001	40	2.0360	103
100	4.4600	101	30	1.9590	301
100	4.3700	110	60	1.9330	113
85	3.6200	111	25	1.8770	131
55	3.0900	020	25	1.7710	203
70	2.8660	102	30	1.7430	302
30	2.7880	201	35	1.7010	123
25	2.5420	211	10	1.6610	321
10	2.3270	202	10	1.6180	004
20	2.1890	220	35	1.5470	104
65	2.1040	212	35	1.5200	223
25	2.0710	221		0.	

COMMENTS.
PROBABLY ISOMORPHOUS WITH 3LIF.UF4. FORMS A SOLID SOLUTION WITH 3LIF.UF4 FROM 25 MOLE PERCENT THF4 TO 10 PERCENT THF4-15 PERCENT UF4.
(C.F.WEAVER,ET.AL., J.AM.CERAM.SOC.,43,213,(1960).)

LITHIUM THORIUM FLUORIDE 7LIF.6THF4

REFERENCES.
ASTM 12-556
L.A.HARRIS,G.D.WHITE AND R.E.THOMA, J.PHYS.CHEM.,63,1974,(1959)

CRYSTAL SYSTEM. TETRAGONAL
A#15.10 C#6.60 Z# 2 DENSITY#4.387

OPTICAL PROPERTIES.
NO#1.502 NE#1.508 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO LIF.2THF4 AND LIQUID AT 597 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
15	6.0700	101	5	2.0180	303
80	5.3600	220	10	2.0010	602
100	4.7500	310	10	1.9810	370
55	4.0100	301	30	1.8920	371,800
50	3.5500	330	10	1.8590	632
55	3.3900	240	15	1.8040	702,741,181
60	3.2100	411	20	1.7810	660,503,343
55	3.0300	202	10	1.7340	253
20	2.8140	222	20	1.6530	004
20	2.7470	501	20	1.6050	124
20	2.5850	350,521	15	1.5930	390
10	2.3920	260	10	1.5590	382
20	2.1370	252,550		0.	

LITHIUM THORIUM FLUORIDE LIF.2THF4

REFERENCES.
ASTM 12-555
L.A.HARRIS,G.D.WHITE AND R.E.THOMA, J.PHYS.CHEM.,63,1974,(1959)

OPTICAL PROPERTIES.
NO#1.554 NE#1.548 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO LIF.4THF4 AND LIQUID AT 762 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.5600	55	2.1230
5	4.3900	50	2.0530
100	3.9800	70	1.9980
10	3.8800	25	1.9670
60	3.5900	20	1.8860
5	3.1950	15	1.7890
20	2.9760	10	1.7630
30	2.8260	10	1.6970
5	2.6730	5	1.6880
20	2.5260	5	1.6600
5	2.3840	5	1.6330

LITHIUM THORIUM FLUORIDE LIF.4THF4

REFERENCES.
ASTM 12-554
L.A.HARRIS,G.D.WHITE AND R.E.THOMA, J.PHYS.CHEM.,63,1974,(1959)

OPTICAL PROPERTIES.
NX#1.528 NZ#1.538 BIAXIAL NEGATIVE,2V#10
POLYSYNTHETIC TWINNING

THERMAL DATA.
MELTS INCONGRUENTLY TO THF4 AND LIQUID AT 897 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	8.3400	35	2.0530
5	7.7600	10	2.0400
5	6.5100	10	2.0180
25	5.8000	30	2.0050
5	4.6200	20	1.9370
70	4.3300	20	1.8200
100	3.8800	5	1.7780
60	3.6000	5	1.7250
10	3.2500	5	1.7190
25	2.9200	5	1.6660
25	2.8220	5	1.6050
10	2.6030	5	1.5950
10	2.3980	5	1.5630
25	2.1370		0.

LITHIUM THULIUM (III) FLUORIDE LIF.TMF3

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.15 C#10.64 Z# 4 DENSITY#5.93

OPTICAL PROPERTIES.
NO#1.470 NE#1.498 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 785 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.6400	101	5	1.7230	222
80	3.0100	112	5	1.6940	301
30	2.9200	103	10	1.5940	116
10	2.6600	004	30	1.5570	312
15	2.5800	200	10	1.5450	303
35	2.2470	211	10	1.5000	224
5	2.1490	114	5	1.4580	107
10	1.9670	105	15	1.4160	321
25	1.9280	213	5	1.3250	323
30	1.8470	204	5	1.2870	400
15	1.8190	220		0.	

LITHIUM URANIUM (IV) FLUORIDE 4LIF.UF4

REFERENCES.
ASTM 10-76
C.J.BARTON,ET.AL., J.AM.CERAM.SOC.,41,63,(1958)

OPTICAL PROPERTIES.
NX#1.460 NZ#1.472 BIAXIAL POSITIVE,2V#45
X#LIGHT GREEN,Z#DARK GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO LIF AND LIQUID AT 500 C.
METASTABLE BELOW 470 C WITH RESPECT TO LIF AND 7LIF.6UF4.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
20	5.6700	30	2.8660
25	5.4600	50	2.7470
70	5.1300	40	2.4680
100	4.9300	20	2.3980
45	4.5500	40	2.2210
100	4.4400	75	2.1670
10	4.2300	20	2.0740
40	3.8200	20	2.0250
30	3.5500	20	1.8720
50	3.0300	25	1.8360
25	2.8900		0.

LITHIUM URANIUM (IV) FLUORIDE 3LIF.UF4

REFERENCES.
ASTM 10-108
C.J.BARTON,ET.AL., J.AM.CERAM.SOC.,41,63,(1958)

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. P4/NMM
A#6.13 C#6.39 Z# 2 DENSITY#5.416

OPTICAL PROPERTIES.
NX#1.512 NZ#1.530 BIAXIAL NEGATIVE,2V#20-30

THERMAL DATA.
THIS COMPOUND HAS ONLY METASTABLE EXISTENCE IN A SYSTEM OF ITS OWN COMPOSITION.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
60	6.4100	001	35	1.9400	301
100	4.4300	101	25	1.9120	113
100	4.3400	110	25	1.8540	131
75	3.5900	111	15	1.7480	203
35	3.0660	020	25	1.7200	302
90	2.8380	102	25	1.6820	123
30	2.7690	201	15	1.6410	321
40	2.5200	211	10	1.5960	004
10	2.3050	112	10	1.5300	400
15	2.1690	220	10	1.5180	223
85	2.0810	212	30	1.4980	232
25	2.0520	221	10	1.4720	303
25	2.0080	103	10	1.4480	330

COMMENTS.
SUPERSEDES ASTM 10-108
SEE 3LIF.THF4

LITHIUM URANIUM (IV) FLUORIDE 7LIF.6UF4

REFERENCES.
ASTM 10-121
C.J.BARTON,ET.AL., J.AM.CERAM.SOC.,41,63,(1958)

CRYSTAL SYSTEM. TETRAGONAL
A#14.85 C#6.52 Z# 2 DENSITY#4.771

OPTICAL PROPERTIES.
NO#1.554 NE#1.550 UNIAXIAL NEGATIVE,DARK GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO LIF.4UF4 AND LIQUID AT 610 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
5	6.6100	120	15	2.2640	NI
20	5.9700	101	10	2.1840	451
15	5.8200	NI	30	2.0970	361
90	5.2400	220	30	2.0600	460
10	5.1500	NI	75	2.0470	442
10	4.6500	121	25	1.9930	033
15	4.3700	NI	20	1.9720	602
55	3.9500	301	25	1.9470	271
15	3.8500	131	15	1.9240	233
20	3.6800	040	30	1.9090	262
75	3.4900	330	45	1.8540	080
90	3.3300	240	20	1.8250	561
70	3.1500	411	20	1.7730	181
10	3.0700	331	25	1.7570	343
100	2.9900	202	15	1.7090	253
30	2.7710	222	15	1.6800	831
30	2.7070	501	15	1.6250	163
25	2.5420	251	25	1.5790	124,282
15	2.3500	260	10	1.5620	761
25	2.2860	611		0.	

COMMENTS.
LATTICE CONSTANTS REFINED BY LEAST SQUARES FIT OF POWDER DATA
THE SPACE GROUP MAY BE P4/N

LITHIUM URANIUM (IV) FLUORIDE LIF.4UF4

REFERENCES.
ASTM 10-76
C.J.BARTON,ET.AL., J.AM.CERAM.SOC.,41,63,(1958)

OPTICAL PROPERTIES.
NX#1.584 NZ#1.600 BIAXIAL NEGATIVE,2V#10
YELLOWISH-GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO UF4 AND LIQUID AT 775 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	7.0200	40	2.8400
10	6.3300	55	2.7710
5	6.0700	10	2.5420
25	5.7300	10	2.3500
10	4.9800	10	2.3100
25	4.7000	10	2.2260
90	4.2500	10	2.2000
20	3.8800	35	2.0880
100	3.7800	60	2.0160
90	3.5200	50	1.9910
10	3.1600	20	1.8880
10	3.1300	10	1.8190
10	3.0600	25	1.7670

LITHIUM YTTRIUM FLUORIDE LIF.YF3

REFERENCES.
R.E.THOMA,ET.AL., J.PHYS.CHEM.,65,1096,(1961)

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.26 C#10.94 Z# 4 DENSITY#3.77

OPTICAL PROPERTIES.
NO#1.454 NE#1.472 UNIAXIAL POSITIVE

THERMAL DATA.
MELT INCONGRUENTLY TO YF3 AND LIQUID AT 819 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.6700	101	60	1.9380	213
90	3.0200	112	40	1.8570	204
15	2.9300	103	20	1.8230	220
15	2.6800	004	10	1.7000	301
10	2.5900	200	15	1.6040	116
90	2.2580	202,211	45	1.5640	215
35	2.1740	114	45	1.5525	312
15	1.9780	105	15	1.5110	224

LITHIUM YTTERBIUM (III) FLUORIDE LIF.YBF3

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I41/A
A#5.14 C#10.59 Z# 4 DENSITY#6.09

OPTICAL PROPERTIES.
NO#1.470 NE#1.496 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 800 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	4.6200	101	20	1.9240	213
70	3.0000	112	60	1.8430	204
50	2.9100	103	10	1.8120	220
15	2.6500	004	10	1.6910	301
15	2.5700	200	10	1.5860	116
40	2.2410	211	30	1.5570	312
10	2.1350	114	10	1.5400	303
5	1.9590	105		0.	

ALPHA LITHIUM ZIRCONIUM FLUORIDE 3LIF.ZRF4

REFERENCES.
ORNL-2548 P52

OPTICAL PROPERTIES.
N#1.420

THERMAL DATA.
MELTS CONGRUENTLY AT 662 C.
ALPHA-BETA TRANSITION AT 475 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	4.5700	10	2.2850
5	4.3700	10	2.1540
10	4.3100	25	2.0430
50	3.2400	10	1.9010
10	3.1000	5	1.8680
10	3.0200	5	1.8490
20	2.6420	25	1.7290

COMMENTS.
SUPERSEDES ASTM 10-119

BETA LITHIUM ZIRCONIUM FLUORIDE 3LIF.ZRF4

REFERENCES.
ORNL-2548 P52

OPTICAL PROPERTIES.
NX#1.455 NZ#1.465 BIAXIAL NEGATIVE,2V#10

THERMAL DATA.
TEMPERATURE RANGE OF STABILITY FROM 470 C TO 475 C.
METASTABLE BELOW 470 C WITH RESPECT TO LIF AND 2LIF.ZRF4.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	4.8900	10	2.0090
35	4.8100	25	1.9400
35	3.6600	25	1.8180
15	3.4200	5	1.8010
30	2.9100	10	1.7880
15	2.7800	5	1.7570
10	2.7200	5	1.7290
20	2.6650	5	1.6010
10	2.4020	15	1.5690
10	2.1020	10	1.5080
65	2.0700	5	1.4480

COMMENTS.
SUPERSEDES ASTM 10-117

LITHIUM ZIRCONIUM FLUORIDE 2LIF.ZRF4

REFERENCES.
ASTM 10-118
ORNL-2548 P52
R.HOPPE AND W.DAHNE,NATURWISSENSCHAFTEN 17,397,(1960)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-31M
A#4.98 C#4.66 Z# 1 DENSITY#3.54

OPTICAL PROPERTIES.
NO#1.468 NE#1.478 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 596 C

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
20	4.6500	001	10	1.5370	211
100	4.2900	100	5	1.4610	103
50	3.1560	101	15	1.4370	300
40	2.1910	111	5	1.3720	301
15	2.1560	200	5	1.3350	212
10	2.0470	102	5	1.3170	113
20	1.9550	201	5	1.2590	203
20	1.7010	112	5	1.2020	221
10	1.6290	210	5	1.1960	310
5	1.5820	202	5	1.1580	311

LITHIUM ZIRCONIUM FLUORIDE 3LIF.4ZRF4

REFERENCES.
ASTM 10-116
ORNL-2548 P52

OPTICAL PROPERTIES.
NX#1.463 NZ#1.473 BIAXIAL POSITIVE,2V#30

THERMAL DATA.
MELTS INCONGRUENTLY TO ZRF4 AND LIQUID AT 520 C.
UNSTABLE WITH RESPECT TO 2LIF.ZRF4 AND ZRF4 AT TEMPERATURES BELOW 466 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
25	6.1100	15	2.6150
35	5.2400	10	2.3030
15	4.9000	10	2.2480
30	4.2100	5	2.2270
10	4.0000	85	2.1940
95	3.9000	15	2.1590
20	3.7700	35	2.1300
5	3.6900	10	2.0430
60	3.3300	35	1.9470
20	3.2900	20	1.9120
20	3.2600	10	1.8830
100	3.1600	10	1.7210

LITHIUM ZIRCONIUM FLUORIDE LIF.4ZRF4

OPTICAL PROPERTIES.
NO#1.582 NE#1.588 UNIAXIAL POSITIVE

THERMAL DATA.
METASTABLE WITH RESPECT TO 3LIF.4ZRF4 AND ZRF4.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
25	5.6100	5	2.0800
100	3.9500	10	1.9340
100	3.8800	90	1.9200
100	3.5400	50	1.8640
10	3.4300	5	1.8420
20	2.7960	10	1.7680
20	2.7630	65	1.7190
70	2.6140	20	1.6800
10	2.5010	5	1.4810

LUTETIUM (III) FLUORIDE LUF3

REFERENCES.
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.18 B#6.73 C#4.45 Z# 4 DENSITY#8.44

OPTICAL PROPERTIES.
NX#1.554 NZ#1.588 BIAXIAL POSITIVE,2V#85

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
30	3.7000	011	10	1.8090	230
80	3.5900	101	10	1.7860	311
30	3.3500	020	10	1.7760	122
100	3.1700	111	25	1.7400	212
35	2.7800	210	10	1.6850	040
40	2.4570	121	25	1.6260	321
15	2.2250	002	10	1.5310	400
10	2.0170	221	10	1.5270	141
15	1.9960	112	10	1.5240	132
20	1.9050	131	10	1.4690	312
20	1.9030	301	10	1.4510	331
35	1.8570	022		0.	

MANGANESE (II) FLUORIDE MNF2

REFERENCES.
M.GRIFFEL AND J.W.STOUT, J.AM.CHEM.SOC.,72,4351,(1950)

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. P42/MNM
A#4.8734 C#3.3103 Z# 2 DENSITY#3.925

OPTICAL PROPERTIES.
NO#1.476 NE#1.504 UNIAXIAL POSITIVE,
X#COLORLESS,Z#GREY

THERMAL DATA.
MELTS AT 929.5 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.4400	110	15	1.7200	220
40	2.7200	101	5	1.6460	002
5	2.4300	200	5	1.5410	310
20	2.3800	111	5	1.4830	112
15	2.3200	210	15	1.4540	301
40	1.8160	211		0.	

NEODYMIUM (III) FLUORIDE NDF3

REFERENCES.
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).
E.STARIZKY AND L.B.ASPREY, ANAL.CHEM.29,857,(1957)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/MCM
A#7.030 C#7.200 Z# 6 DENSITY#6.506

OPTICAL PROPERTIES.
NO#1.628 NE#1.621 UNIAXIAL NEGATIVE,BROWN

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	3.5800	002	10	1.6000	114
15	3.4900	110	5	1.5770	222
95	3.1400	111	30	1.4150	223
5	3.0300	200	25	1.3430	304
10	2.5150	112	15	1.3310	115
5	2.3100	202	30	1.3050	411
5	2.1890	121	5	1.2550	224
65	2.0220	300	10	1.2450	412
100	1.9740	113	10	1.1990	006
15	1.7950	004	15	1.1710	330
50	1.7640	302	30	1.1610	413
35	1.7030	221	10	1.1340	116

NICKEL (II) FLUORIDE NIF2

REFERENCES.
ASTM 1-0672

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. P42/MNM
A#4.71 C#3.118 Z# 2 DENSITY#4.63

OPTICAL PROPERTIES.
NO#1.526 NE#1.560 UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.3100	110	10	1.5190	002
62	2.5600	101	15	1.3860	301
20	2.2300	111	5	1.2600	202
62	1.7210	211	5	1.1220	222
15	1.6500	220		0.	

NICKEL (II) URANIUM (VI) OXIDE NIO.3U03

REFERENCES.
W.L.MARSHALL AND J.S.GILL, J.INORG.NUCL.CHEM.,26,277,(1964)

THERMAL DATA.
STABLE TO 900 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	5.0900	5	2.0760
5	4.6900	20	2.0190
100	4.0400	5	1.9630
5	3.6700	5	1.8860
20	3.2700	5	1.8330
5	2.9500	5	1.7230
5	2.6270	10	1.7100
10	2.5540	5	1.6330
5	2.5300	5	1.5100
5	2.4790	5	1.3600
5	2.1940	5	1.3100
5	2.1020		0.

NICKEL (II) ZIRCONIUM FLUORIDE NIF2.ZRF4

REFERENCES.
ASTM 10-115, C.BROSSET, Z.ANORG.CHEM.,239,303,(1938)

OPTICAL PROPERTIES.
N#1.442 VERY LOW BIREFRINGENCE

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
15	4.8800	5	2.1740
5	4.5000	50	1.9640
100	3.9100	55	1.7670
50	2.8050	15	1.7450
10	2.7630	10	1.6220
15	2.3670	10	1.5960

POTASSIUM ALUMINUM FLUORIDE KF.ALF3

REFERENCES.
ASTM 2-0595

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. P4/MMM
A#3.550 C#6.139

OPTICAL PROPERTIES.
NO#1.380 NE#1.371 UNIAXIAL NEGATIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
20	3.5700	100	50	1.5380	004
100	3.0800	101,002	20	1.4140	212,104
50	2.5200	110	20	1.3130	114
70	2.3200	111,102	70	1.2580	220,213
50	2.0500	003	50	1.1650	
100	1.7790	200,103	50	1.1630	
70	1.5400	211,202		0.	

POTASSIUM ALUMINUM FLUORIDE 3KF.ALF3

REFERENCES.
ASTM 3-0615

CRYSTAL SYSTEM. CUBIC
A#8.49

OPTICAL PROPERTIES.
N#1.368 VERY LOW BIREFRINGENCE,MONOCLINIC TWINNING

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
13	4.9500	111	33	1.7200	422
8	4.2800	200	10	1.6300	511,333
100	3.0000	220	37	1.4900	440
5	2.5500	311	3	1.4300	531
42	2.4500	222	5	1.4100	600
67	2.1100	400	13	1.3400	620
5	1.9400	331		0.	

POTASSIUM BERYLLIUM FLUORIDE 3KF.BEF2

REFERENCES.
ASTM 11-114
ORNL-2548 P 36

OPTICAL PROPERTIES.
NO#1.357 NE#1.366 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 740 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	3.4200	5	2.0400
5	3.3000	5	1.9600
20	3.0700	10	1.8500
75	2.9800	10	1.7800
10	2.8100	10	1.7300
30	2.6400	10	1.7200
40	2.5400	5	1.6900
15	2.5100	5	1.6000
100	2.3900	5	1.5600
70	2.2700	5	1.5400

BETA POTASSIUM BERYLLIUM FLUORIDE 2KF.BEF2

REFERENCES.
ORNL-2548 P 36
ASTM 3-0930, H.ODANIEL AND L.TSCHEISCHWILI,Z.KRIST.104,350,(1942)

CRYSTAL SYSTEM. ORTHORHOMBIC
A#5.70 B#9.90 C#7.28 Z# 4 DENSITY#2.65

OPTICAL PROPERTIES.
NX#1.357 NZ#1.366 BIAXIAL POSITIVE,2V#30,ANGLE X-C#40

THERMAL DATA.
ALPHA-BETA TRANSITION AT 685 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	3.4200	012	35	2.1840	212
15	3.3100	121	25	2.1590	230
10	3.2400	NI	5	2.1060	NI
40	3.1400	NI	5	2.0600	231
10	3.0700	102	10	2.0380	123
10	2.9900	031	10	1.9550	033
40	2.9500	022	10	1.9200	142
100	2.8400	200	10	1.9050	300
20	2.7300	210	10	1.8940	NI
20	2.6100	122	10	1.8540	232
10	2.5800	211	15	1.8150	213
85	2.4650	220	15	1.7360	104
85	2.3590	013	35	1.7080	024,114
55	2.3320	221	5	1.6570	143
5	2.2590	132	5	1.6410	330
15	2.2420	202		0.	

POTASSIUM BERYLLIUM FLUORIDE KF.BEF2

REFERENCES.
ORNL-2548 P 36

OPTICAL PROPERTIES.
NX#1.318 NZ#1.323 BIAXIAL NEGATIVE,2V#45

THERMAL DATA.
MELTS INCONGRUENTLY TO BETA 2KF.BEF2 AND LIQUID AT 390 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
15	6.6500	5	2.5420
60	5.9900	5	2.4420
5	3.6900	5	2.4100
10	3.5800	15	2.2920
90	3.3300	5	2.2200
35	3.2300	5	2.1900
100	3.0100	35	2.0100
5	2.9200	25	1.9790
15	2.7340	5	1.7450
10	2.6360	10	1.6410

ALPHA POTASSIUM BERYLLIUM FLUORIDE KF.2BEF2

REFERENCES.
ASTM 10-110, ORNL-2548,P36

OPTICAL PROPERTIES.
NO#1.319 NE#1.312 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 358 C, ALPHA-BETA INVERSION AT 334 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.9900	15	2.2900
15	3.6600	15	2.2100
60	3.3100	15	2.1400
100	3.0000	5	2.0800
5	2.6500	5	2.0100
5	2.5500	5	2.0000
5	2.4400	5	1.8300
15	2.3900	10	1.7800
5	2.3700	5	1.6000

BETA POTASSIUM BERYLLIUM FLUORIDE KF.2BEF2

REFERENCES.
ORNL-2548,P36

OPTICAL PROPERTIES.
N#1.319 BIAXIAL

THERMAL DATA.
ALPHA-BETA INVERSION AT 334 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
20	8.2000	100	3.2500
10	7.2500	35	3.1400
10	6.5600	100	3.0100
5	6.1900	40	2.6440
15	5.4000	20	2.5010
5	5.2000	10	2.4550
30	4.9300	25	2.2700
25	4.4800	5	2.2530
15	4.2900	80	2.1640
20	4.1500	40	2.0740
100	3.8800	15	1.9870
40	3.7400	20	1.9720
20	3.3400	20	1.8680

POTASSIUM CHROMIUM (III) FLUORIDE 3KF.CRF3

REFERENCES.
ASTM 10-111

CRYSTAL SYSTEM. CUBIC
A#12.13

OPTICAL PROPERTIES.
N#1.422 GREEN

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
35	4.9500	211	20	2.1540	440
15	4.2600	220	55	2.1350	441
35	3.3500	320	15	1.7430	444
100	3.0300	400	15	1.5160	800
25	2.4750	422		0.	

POTASSIUM HYDROGEN FLUORIDE KF.HF

REFERENCES.
ASTM 1-1095

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I4/MCM
A#5.67 C#6.81 Z# 4 DENSITY#1.79

OPTICAL PROPERTIES.
NO#1.374 NE#1.331 UNIAXIAL NEGATIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
40	4.0300	110	1	1.4910	NI
30	2.8500	200	7	1.4630	204
100	2.6000	112	13	1.3130	402
50	2.3800	211	5	1.3030	323,224
50	2.1800	202	6	1.2720	420
15	2.0100	220	7	1.2510	332
40	1.7990	310	9	1.2410	314
13	1.7310	222	4	1.1910	422
20	1.6990	004	3	1.1140	510
1	1.6410	NI	3	1.0930	404,116
5	1.5920	312	3	1.0600	512
4	1.5680	114	3	1.0200	424
4	1.5340	321		0.	

POTASSIUM IRON (II) CHLORIDE 2KCL.FECL2

REFERENCES.
C.BEUSMAN,ORNL-2323
H.L.PINCH AND J.M.HIRSHAN, J.AM.CHEM.SOC.,79,6149,(1957)

OPTICAL PROPERTIES.
NO#1.600 NE#1.636 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO KF AND LIQUID AT 385 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	6.0200	25	2.5180
15	5.6900	15	2.4890
25	4.0600	50	2.4670
75	3.4700	15	2.2030
15	3.1000	15	2.1080
30	2.8600	15	2.0220
100	2.6750	25	1.9440
50	2.6150	30	1.8840
100	2.5900	25	1.7490

POTASSIUM IRON (II) CHLORIDE KCL.FECL2

REFERENCES.
C.BEUSMAN,ORNL-2323
H.L.PINCH AND J.M.HIRSHAN, J.AM.CHEM.SOC.,79,6149,(1957)

OPTICAL PROPERTIES.
NX#1.700 NZ#1.740 BIAXIAL POSITIVE,2V#20

THERMAL DATA.
MELTS CONGRUENTLY AT 400 C

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
30	7.5000	30	2.2760
30	7.2000	15	2.2430
30	4.1700	15	2.1240
30	3.4300	15	1.9800
25	3.1100	10	1.9570
20	2.8900	35	1.9400
100	2.8300	50	1.9240
30	2.7500	10	1.8990
35	2.6950	10	1.8510
100	2.6600	25	1.8320
15	2.4950	15	1.7890

POTASSIUM LANTHANUM FLUORIDE KF.LAF3

REFERENCES.
ASTM 11-112
W.H.ZACHARIASEN, J.AM.CHEM.SOC.,70,2147,(1948)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-62M
A#6.526 C#3.791 Z#3/2 DENSITY#4.52

OPTICAL PROPERTIES.
NO#1.493 NE#1.510 UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	7.7700	25	1.9510
70	5.6100	20	1.9200
35	4.9000	12	1.8940
40	3.3200	30	1.8830
60	3.2600	65	1.8570
65	3.1500	20	1.6620
100	2.7470	5	1.6410
40	2.2090	20	1.5770

POTASSIUM LITHIUM BERYLLIUM FLUORIDE KF.LIF.BEF2

OPTICAL PROPERTIES.
N(AVERAGE)#1.321 BIAXIAL,VERY LOW BIREFRINGENCE

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
30	4.3700	50	2.1790
60	3.5800	50	2.1400
100	3.0600	10	1.9470
10	2.6800	10	1.9200
25	2.5300	10	1.8900
100	2.4210	10	1.6570
35	2.1940	10	1.6270

POTASSIUM LITHIUM ZIRCONIUM FLUORIDE KF.LIF.ZRF4

OPTICAL PROPERTIES.
NO#1.403 NE#1.407 UNIAXIAL POSITIVE
POLYSYNTHETIC TWINNING

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.5300	5	2.0880
100	4.4700	15	2.0130
5	4.1600	5	1.9840
40	3.7900	25	1.8940
5	3.2880	10	1.8430
65	3.1950	10	1.8380
35	3.1230	10	1.8290
5	2.5970	5	1.6570
5	2.5330	10	1.6270
5	2.4150	5	1.6060
20	2.2960	5	1.5940
15	2.2330		0.

POTASSIUM NICKEL (II) FLUORIDE 2KF.NIF2

REFERENCES.
G.WAGNER AND D.BALZ, Z.ELECTROCHEM.,56,576,(1952)

OPTICAL PROPERTIES.
NO#1.434 NE#1.426 UNIAXIAL NEGATIVE,YELLOW

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	6.5100	15	2.1350
45	5.8500	55	1.9990
10	3.8300	10	1.8050
55	2.9400	30	1.7300
35	2.8300	10	1.6540
5	2.3440	35	1.6330
10	2.2120	10	1.5940
100	2.1730	25	1.4740

COMMENTS.
XRAY PATTERN AT VARIANCE WITH ASTM 1-0985.

POTASSIUM SODIUM BERYLLIUM FLUORIDE KF.NAF.BEF2

REFERENCES.
ASTM 10-106

OPTICAL PROPERTIES.
N#1.434 BIAXIAL POSITIVE,2V#SMALL,VERY LOW BIREFRIGENCE

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	7.0800	15	2.2120
25	3.8500	10	2.1890
15	3.1700	10	2.1590
30	3.0800	5	2.1250
60	2.8660	60	1.9950
100	2.7860	10	1.9670
10	2.6750	5	1.8190
60	2.6260	5	1.8060
10	2.5930	25	1.7770
15	2.5280	10	1.6910
10	2.4100	10	1.6200
100	2.3670	15	1.6050
70	2.2870		0.

POTASSIUM SODIUM CHROMIUM (III) FLUORIDE 2KF.NAF.CRF3

REFERENCES.
ASTM 10-174

CRYSTAL SYSTEM. CUBIC
A#8.28

OPTICAL PROPERTIES.
N#1.422

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
30	4.7800	111	65	2.3850	222
20	4.1400	200	5	2.2920	320
95	2.9300	220	100	2.0690	400
10	2.4950	311	55	1.6880	422

POTASSIUM SODIUM THORIUM FLUORIDE KF.NAF.THF4

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P3 OR P-3
A#6.29 C#7.88 Z# 2 DENSITY#5.02

OPTICAL PROPERTIES.
NO#1.454 NE#1.448 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS SEMI-CONGRUENTLY TO 7NAF.6THF4 AT 674 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	7.8200	001	5	1.8890	023
10	5.4200	010	10	1.8500	014
35	4.4600	011	15	1.8260	122
5	3.9300	002	10	1.6710	114
55	3.1800	012	5	1.6200	123
20	3.1400	110	5	1.5960	024
10	2.9200	111	5	1.5750	005
5	2.7200	020	10	1.5130	015
5	2.6200	003	5	1.4240	124
5	2.5690	021	5	1.4100	115
5	2.4530	112	5	1.3650	025
10	2.3600	013	5	1.3350	034
20	2.2360	022	10	1.2770	016
1	2.0560	120	2	1.2530	215
10	2.0150	113	5	1.1920	035
5	1.9920	121	5	1.1840	206
20	1.9670	004	5	1.1080	216

POTASSIUM SODIUM URANIUM (IV) FLUORIDE KF.NAF.UF4

REFERENCES.
ASTM 10-109

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P3 OR P-3
A#6.24 C#7.80 Z# 2 DENSITY#5.23

OPTICAL PROPERTIES.
NO#1.578 NE#1.584 UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	7.7960	001	10	1.9980	113
40	5.4200	010	5	1.9790	121
70	4.4600	011	20	1.9490	004
100	3.1600	012	10	1.8730	023
50	3.1300	110	10	1.8330	014
20	2.9000	111	35	1.8070	030,122
10	2.7060	020	10	1.7550	031
5	2.5920	003	15	1.6530	114
5	2.4420	112	10	1.6050	123
10	2.3410	013	5	1.5800	024
55	2.2220	022	5	1.5610	005
5	2.0440	120	5	1.4980	015

POTASSIUM SODIUM ZIRCONIUM FLUORIDE KF.NAF.ZRF4

REFERENCES.
ASTM 10-102

OPTICAL PROPERTIES.
NX#1.378 NZ#1.385 BIAXIAL NEGATIVE,2V#60

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.9900	5	2.7470
50	5.3700	25	2.6900
15	4.9800	20	2.5560
60	4.8500	25	2.4890
50	4.5000	20	2.4050
5	4.4100	20	2.2580
30	4.2500	20	2.2150
65	4.0900	20	2.1540
30	3.6900	35	2.0500
10	3.6000	20	1.9470
5	3.5200	10	1.9280
100	3.3400	10	1.8860
45	3.2600	15	1.7920
40	3.1800	20	1.7430
10	3.1200	15	1.7230
10	3.0700	5	1.6940
40	3.0100	25	1.6510

POTASSIUM SODIUM ZIRCONIUM FLUORIDE 3KF.2NAF.5ZRF4

REFERENCES.
ORNL-2548 P62,ASTM 10-104.

OPTICAL PROPERTIES.
NX#1.474 NY#1.484 NZ#1.492 BIAXIAL NEGATIVE,2V#75
INCLINED EXTINCTION ABOUT 17 DEGREES
POLYSYNTHETIC TWINNING

THERMAL DATA.
MELTS CONGRUENTLY AT 432C

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	8.5100	5	2.5800
100	7.7000	5	2.4700
5	6.2000	10	2.3900
5	5.5700	10	2.3300
10	5.1500	5	2.1900
20	5.0100	10	2.1600
10	4.7700	50	2.1400
35	4.6500	10	2.0900
40	4.2900	10	2.0600
100	3.8600	30	1.9500
15	3.7500	90	1.9400
15	3.5000	10	1.9100
50	3.4000	10	1.8900
5	3.2300	15	1.8800
60	3.1700	5	1.8400
35	3.0900	5	1.8100
5	2.8700	10	1.7600
10	2.8000	15	1.7000

POTASSIUM SODIUM ZIRCONIUM FLUORIDE 3KF.3NAF.2ZRF4

REFERENCES.
ASTM 10-105

OPTICAL PROPERTIES.
NX#1.412 NZ#1.422 BIAXIAL POSITIVE,2V#30

THERMAL DATA.
MELTS INCONGRUENTLY TO 3KF.ZRF4 AND LIQUID

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
15	6.1100	5	2.5850
100	4.9000	25	2.4550
25	4.8200	20	2.4170
15	4.5500	10	2.3680
55	4.2700	25	2.2700
75	4.0900	50	2.2260
10	3.7800	40	2.1350
20	3.4000	50	2.0510
20	3.2800	15	1.9310
20	2.9900	40	1.8220
90	2.9700	20	1.7480
10	2.7200	25	1.7210
10	2.6820		0.

POTASSIUM TELLURIUM FLUORIDE KF.TEF4.H2O

REFERENCES.
ASTM 10-103

OPTICAL PROPERTIES.
NX#1.436 NZ#1.460 BIAXIAL POSITIVE,2V#30

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	5.6400	10	2.1340
60	4.6100	10	2.0340
100	4.2700	45	1.9630
10	3.9500	20	1.8720
75	3.5750	10	1.8120
15	3.1700	10	1.7790
25	2.9100	15	1.7420
50	2.8050	5	1.6410
25	2.3030	10	1.6060

POTASSIUM THORIUM FLUORIDE 5KF.THF4

REFERENCES.
W.J.ASKER,E.R.SEGNIT AND A.W.WYLIE,J.CHEM.SOC.,4470,(1952)

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. CCMM
A#12.87 B#7.90 C#10.83 Z# 4 DENSITY#3.60

OPTICAL PROPERTIES.
NX#1.397 NZ#1.403 BIAXIAL NEGATIVE,2V#80

THERMAL DATA.
UNSTABLE ABOVE 635 C WITH RESPECT TO KF AND 7KF.2THF4.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
51	8.5000	241,042	20	2.5100	114,131
30	6.6500	110	15	2.4900	204,420
15	6.0000	200	20	2.3800	403,421
10	5.8100	111	15	2.2800	422
100	5.6700	201	10	2.2500	330
80	5.4800	002	10	2.2200	024
10	4.1100	202	10	2.2000	314,331
10	3.9100	020	20	2.1870	224
45	3.7500	310	20	2.0810	404,133
30	3.5400	311	20	2.0810	133
30	3.3700	220	5	2.0470	423
60	3.2000	022,221,400	25	1.9710	040
30	3.1600	113	15	1.9010	333
85	3.1300	203	10	1.8360	424
5	3.0700	312	20	1.7920	242
10	3.0500	401	10	1.7140	334
10	2.9100	222	20	1.6970	440
35	2.6900	004	5	1.6070	442

COMMENTS.
INDEXED BY J.H.BURNS

POTASSIUM THORIUM FLUORIDE 7KF.2THF4

OPTICAL PROPERTIES.
NO#1.408 NE#1.413 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO 3KF.THF4 AND LIQUID AT 837 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
20	5.8200	5	2.1790
45	5.6400	5	2.1060
35	5.0600	5	1.9510
10	4.0700	45	1.8790
80	3.2600	5	1.8470
100	3.1000	10	1.6790
70	2.2940	15	1.6380

POTASSIUM THORIUM FLUORIDE 3KF.THF4

REFERENCES.
W.J.ASKER,E.R.SEGNIT AND A.W.WYLIE,J.CHEM.SOC.,4470,(1952)

OPTICAL PROPERTIES.
N#1.412

THERMAL DATA.
MELTS CONGRUENTLY AT 865 C.
UNSTABLE BELOW 570 C WITH RESPECT TO 2KF.THF4 AND 7KF.2THF4

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.2750	25	2.2980
10	5.0400	40	1.8770
10	4.5300	10	1.6290
100	3.2400	5	1.4560
20	3.1600		0.

POTASSIUM THORIUM FLUORIDE 2KF.THF4

REFERENCES.
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
W.J.ASKER,E.R.SEGNIT AND A.W.WYLIE,J.CHEM.SOC.,4470,(1952)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. C-62M
A#6.565 C#3.815 Z# 10 DENSITY#4.82

OPTICAL PROPERTIES.
NO#1.463 NE#1.488 UNIAXIAL POSITIVE

THERMAL DATA.
UNSTABLE ABOVE 645 C WITH RESPECT TO 3KF.THF4 AND 7KF.6THF4

XRAY DATA.

I/I	D-OBS		I/I	D-OBS	
10	6.2800		30	2.1490	210
100	5.6860	100	55	1.8950	300
10	4.5250		60	1.8720	211
10	3.8150	001	15	1.8080	
90	3.2820	110	10	1.6970	301
80	3.1680	101	15	1.6410	220
45	2.8430	200	15	1.5780	
20	2.4880	111	5	1.5080	221
55	2.2790	201		0.	

POTASSIUM THORIUM FLUORIDE 7KF.6THF4

REFERENCES.
W.J.ASKER,E.R.SEGNIT AND A.W.WYLIE,J.CHEM.SOC.,4470,(1952)

CRYSTAL SYSTEM. RHOMBOHEDRAL SPACE GROUP. R-3
A#9.510 ALPHA#107.28 Z# 1 DENSITY#5.27

OPTICAL PROPERTIES.
NO#1.474 NE1.470 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 895 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
45	8.2300	100	30	2.7400	300
10	7.6900	1-10	15	2.3250	301
15	5.6400	11-1	10	2.2580	20-4
45	4.8900	110	15	2.2310	4-10
50	4.5400	2-10	10	2.1720	23-3
10	4.4400	11-2	20	2.1400	1-2-3
10	4.1800	112	45	2.1300	03-4,1-43
20	4.1200	200	5	2.0130	14-3,113
10	3.8400	2-20	5	1.9880	1-14
15	3.6200	21-1	5	1.8680	33-3
100	3.4800	12-2	45	1.8190	2-50
15	3.1600	11-3	10	1.6120	1-45
35	3.0200	3-10	10	1.5090	03-6
10	2.9000	12-3		0.	

COMMENTS.
REPORTED BY ASKER,SEGNIT AND WYLIE AS KF.THF4.
THE 7-6 RUBIDIUM,POTASSIUM AND SODIUM COMPOUNDS WITH
URANIUM AND THORIUM ARE ISOMORPHOUS
THE HEXAGONAL AXES ARE A#15.32 C#10.49

POTASSIUM THORIUM FLUORIDE KF.2THF4

REFERENCES.
W.J.ASKER,E.R.SEGNIT AND A.W.WYLIE,J.CHEM.SOC.,4470,(1952)

OPTICAL PROPERTIES.
NX#1.490 NZ#1.532 BIAXIAL NEGATIVE,2V#16

THERMAL DATA.
MELTS INCONGRUENTLY TO BETA KF.3THF4 AND LIQUID AT 920 C

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	5.8600	5	2.4700
10	5.6400	10	2.3100
5	5.0900	10	2.2700
25	4.4600	40	2.2200
10	4.1500	20	2.1500
10	4.0600	15	2.1200
25	3.7800	15	2.0700
15	3.5900	45	1.9800
15	3.5400	20	1.9700
25	3.4200	10	1.9200
15	3.3400	10	1.8500
25	3.1800	15	1.7900
5	3.0600	5	1.7700
10	2.9700	15	1.6300
25	2.9000		0.

ALPHA POTASSIUM THORIUM FLUORIDE KF.3THF4

REFERENCES.
W.J.ASKER,E.R.SEGNIT AND A.W.WYLIE,J.CHEM.SOC.,4470,(1952)

OPTICAL PROPERTIES.
NO#1.534 NE#1.519 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS INCRONGUENTLY TO THF4 AND LIQUID AT 950 C.
ALPHA-BETA TRANSITION AT 939 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
35	8.5800	45	3.1500
25	8.2600	55	2.9600
75	7.0800	30	2.5690
45	5.9000	30	2.5620
30	4.8200	25	2.4090
100	4.2500	55	2.0830
85	4.2100	30	1.9920
25	3.7700	35	1.9430
90	3.5900	45	1.8720
40	3.4900	20	1.7990
25	3.4100		0.

BETA POTASSIUM THORIUM FLUORIDE KF.3THF4

REFERENCES.
W.J.ASKER,E.R.SEGNIT AND A.W.WYLIE,J.CHEM.SOC.,4470,(1952)

OPTICAL PROPERTIES.
NX#1.515 NZ#1.528 BIAXIAL POSITIVE,2V#15

THERMAL DATA.
ALPHA-BETA TRANSITION AT 939 C.
BETA-GAMMA TRANSITION AT 810 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	7.9900	10	2.1140
10	7.2500	100	2.0340
25	5.7700	60	1.9780
35	5.5300	50	1.9090
10	5.4000	15	1.8430
25	4.5700	45	1.7860
35	4.3000	22	1.7450
30	4.0500	10	1.6910
45	3.7000	10	1.6220
80	3.5400	15	1.5610
50	3.3700	5	1.5370
45	3.2800	5	1.5290
20	3.1100	10	1.4500
25	2.9500	10	1.3530
10	2.7400	15	1.3410
10	2.7100	5	1.3030
10	2.6800	5	1.2650
15	2.5900	10	1.2460
5	2.3700	10	1.1820
10	2.3000	10	1.1470
5	2.1840		0.

GAMMA POTASSIUM THORIUM FLUORIDE KF.3THF4

REFERENCES.
W.J.ASKER,E.R.SEGNIT AND A.W.WYLIE,J.CHEM.SOC.,4470,(1952)

OPTICAL PROPERTIES.
NX#1.507 NZ#1.529 BIAXIAL NEGATIVE,2V#10

THERMAL DATA.
BETA-GAMMA TRANSITION AT 810 C.
METASTABLE BELOW 715 C WITH RESPECT TO KF.2TH4 AND THF4.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
55	7.0200	30	2.5500
100	5.9000	30	2.4800
25	4.7900	25	2.2300
90	4.2500	85	2.0900
55	4.1700	40	1.9710
45	3.8600	55	1.9430
85	3.2100	70	1.8680
65	2.9500	30	1.5690
45	2.9000		0.

COMMENTS.
ASKER,SEGNIT AND WYLIE SHOW ONLY ONE FORM OF KF.3TH4
BUT LATER UNPUBLISHED WORK BY THOMA ET AL SHOWS 3 FORMS
OF KF.3THF4

POTASSIUM URANIUM (III) CHLORIDE 2KCL.UCL3

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNA21 OR PNMA
A#12.71 B#8.82 C#8.00 Z# 4 DENSITY#3.70

OPTICAL PROPERTIES.
NX#1.745 NZ#1.800 BIAXIAL POSITIVE,2V#VERY SMALL
VERY DEEP BLOOD-RED COLOR

THERMAL DATA.
MELTS CONGRUENTLY AT 620 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	6.8000	101	10	2.3300	511
60	6.3900	200	5	2.2600	303
20	5.9400	011	10	2.2020	232,040
10	4.4300	020	10	2.1690	422
25	4.3500	211	20	2.1300	502,521
20	4.0100	002	15	2.0880	512,431
35	3.7600	102,301	10	2.0700	332
50	3.7000	121	5	2.0470	601,403
40	3.6400	220	15	1.9960	611,413
30	3.5000	112	10	1.9750	104,033
10	3.3900	202	5	1.9280	522,114
10	3.1800	400	20	1.9130	620,142
10	3.1500	212	5	1.8860	233
10	2.9600	022	5	1.8780	602
5	2.9200	401	10	1.7730	314,701
10	2.8900	302	5	1.7630	342
5	2.8600	122,321	10	1.6780	631
15	2.8100	411	10	1.6460	721
25	2.7700	312,031	20	1.6410	134
35	2.6900	131,222	15	1.6330	541
5	2.6200	103	5	1.5740	015,504
10	2.5900	402	5	1.5670	252,810
25	2.5600	013	5	1.5410	334,542
10	2.5300	231	10	1.5290	640
5	2.4900	402	5	1.4960	305,820,125
10	2.4200	322	10	1.4710	144,053,060
20	2.3700	213		0.	

COMMENTS.
VERY HYGROSCOPIC

POTASSIUM URANIUM (IV) FLUORIDE 3KF.UF4

REFERENCES.
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)
J.H.BURNS,ORNL-3262,P16,(1962)

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMM OR PNM21
A#6.59 B#8.30 C#7.20

OPTICAL PROPERTIES.
NX#1.410 NZ#1.426

THERMAL DATA.
MELTS CONGRUENTLY AT 957 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
20	7.2000	001	5	2.3980	131
80	5.4400	011	5	2.3320	212
60	5.1500	110	10	2.1760	113
40	4.8500	101	5	2.1230	310
20	4.1900	111	5	2.1040	301
45	3.5900	021	45	2.0780	023
35	3.2900	200	5	2.0310	231
100	3.1600	121	5	1.9080	141
10	2.9500	112	25	1.8770	302
10	2.8170	211	5	1.8280	312
5	2.7150	022	25	1.7590	014
15	2.5780	220	10	1.7370	104
5	2.5500	130	5	1.6050	401
10	2.5080	122	5	1.5800	204
25	2.4360	202		0.	

COMMENTS.
THESE XRAY DATA ARE DIFFERENT FROM THOSE REPORTED BY ZACHARIASEN ON ASTM 12-45,8-61 AND 8-23.

POTASSIUM URANIUM (IV) FLUORIDE 2KF.UF4

REFERENCES.
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-62M
A#6.54 C#3.76

OPTICAL PROPERTIES.
NO#1.484 NE#1.512 UNIAXIAL POSITIVE,LIGHT OLIVE DRAB

THERMAL DATA.
STABLE FROM 608 TO 755 C.
MELTS INCONGRUENTLY TO 3KF.UF4 AND LIQUID AT 755 C.
METASTABLE BELOW 608 C WITH RESPECT TO 3KF.UF4 AND 7KF.6UF4.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.6300	100	10	1.7750	012
5	3.7200	001	10	1.6840	031
40	3.2600	110	5	1.6340	220
45	3.1100	101	10	1.6220	112
20	2.8200	200	5	1.5700	130
10	2.4560	111	10	1.4470	311
25	2.2520	201	5	1.4080	122
10	2.1370	120	5	1.3260	041
20	1.8840	300,002	5	1.3000	230
30	1.8560	211	5	1.2280	231

POTASSIUM URANIUM (IV) FLUORIDE 7KF.6UF4

REFERENCES.
ASTM 10-150
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)
L.A.HARRIS,ORNL CF 58-3-15(1958)

CRYSTAL SYSTEM. RHOMBOHEDRAL
A#9.376 ALPHA#107.20 Z# 1 DENSITY#5.58

OPTICAL PROPERTIES.
NO#1.504 NE#1.510 UNIAXIAL NEGATIVE,GREEN

THERMAL DATA.
MELTS CONGRUENTLY AT 789 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	8.1100	100	70	2.1110	23-1
20	7.5000	10-1	80	2.0960	13-4
15	5.5400	11-1	10	2.0470	122
60	4.8200	101	10	2.0300	1-24,040
50	4.4600	021	40	1.9870	1-34
30	4.3500	11-2	40	1.9830	131
15	4.0600	200	10	1.9590	1-14
55	3.7800	2-20	10	1.9130	203
20	3.5800	1-12	10	1.8610	12-5
100	3.4400	111,12-2	10	1.8400	11-5
10	3.1200	11-3	45	1.8020	140
65	2.9700	1-30	70	1.7930	2-34
15	2.8850	20-3	70	1.7890	2-24
20	2.8580	12-3	10	1.7570	33-4,03-5
15	2.7100	2-12,300	10	1.7300	222,23-5
10	2.5500	13-1,112	30	1.7150	42-4
10	2.5150	30-3	10	1.6540	1-25,1-35
10	2.4090	220	10	1.6060	303
20	2.3330	11-4	10	1.5890	1-15
25	2.2980	130	10	1.5820	3-34
30	2.2000	2-23	10	1.5530	4-23
15	2.1400	23-3		0.	

COMMENTS.
THE 7-6 RUBIDIUM,POTASSIUM AND SODIUM COMPOUNDS WITH
URANIUM AND THORIUM ARE ISOMORPHOUS
THE HEXAGONAL AXES ARE A#15.09 C#10.38

POTASSIUM URANIUM (IV) FLUORIDE KF.2UF4

REFERENCES.
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNAM
A#8.68 B#11.44 C#7.02 Z# 4 DENSITY#6.49

OPTICAL PROPERTIES.
NX#1.520 NZ#1.584 BIAXIAL NEGATIVE,2V#15,GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO UF4 AND LIQUID AT 765 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	8.1100	10	2.4210
10	6.3700	15	2.2150
10	5.9900	5	2.1940
100	5.7200	20	2.1790
15	5.4300	15	2.1490
10	4.9300	15	2.1110
60	4.3300	20	2.0740
25	4.0600	40	2.0260
20	3.9500	45	1.9470
5	3.7900	30	1.9280
50	3.6900	15	1.8900
25	3.5200	10	1.8750
35	3.4700	15	1.8190
75	3.3600	5	1.7570
45	3.2600	10	1.7350
15	3.1300	10	1.7140
60	3.1100	5	1.6770
10	2.9700	10	1.6490
15	2.8660	10	1.6090
45	2.8310	15	1.6010
10	2.6750	25	1.5950
10	2.6590		0.

POTASSIUM URANIUM (IV) FLUORIDE KF.6UF4

REFERENCES.
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. C6/MMC
A#8.18 C#16.42 Z# 2 DENSITY#6.73

OPTICAL PROPERTIES.
N(AVERAGE)#1.595 UNIAXIAL NEGATIVE, GREEN

THERMAL DATA.
METASTABLE WITH RESPECT TO KF.2UF4 AND UF4.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	8.2100	002	5	2.7370	006
10	7.0800	100	5	2.6820	204
15	6.5000	101	5	2.4080	205
10	4.3300	103	5	2.2430	124
100	4.1100	004	70	2.0520	008,034
10	3.5500	104	20	1.9560	207
25	3.4600	201	5	1.9110	132
5	2.9790	105	5	1.8340	118
15	2.8970	114	20	1.8300	224

POTASSIUM ZINC FLUORIDE KF.ZNF2

REFERENCES.
ASTM 6-0439

CRYSTAL SYSTEM. CUBIC SPACE GROUP. PM3M
A#4.056 Z# 1 DENSITY#4.02

OPTICAL PROPERTIES.
N#1.462

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
35	4.0550	100	1	1.1250	320
100	2.8690	110	11	1.0840	321
15	2.3430	111	3	1.0140	400
60	2.0290	200	2	0.9839	410
14	1.8140	210	6	0.9561	411
31	1.6560	211	8	0.9070	420
26	1.4340	220	2	0.8850	421
5	1.3520	300	3	0.8648	332
10	1.2830	310	6	0.8279	422
6	1.1710	222	7	0.7955	510

POTASSIUM ZIRCONIUM FLUORIDE 3KF.ZRF4

REFERENCES.
ASTM 10-372
ORNL-2548 P56
R.E.THOMA,B.J.STURM AND E.H.GUINN,ORNL-3594

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#8.988 Z# 4 DENSITY#3.123

OPTICAL PROPERTIES.
N#1.408

THERMAL DATA.
MELTS CONGRUENTLY AT 920 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
40	5.1900	111	5	1.2584	711
25	4.4950	200	13	1.2011	642
100	3.1770	220	5	1.1702	731
9	2.7100	311	3	1.1242	800
31	2.4660	640	3	1.0981	733
50	2.2470	400	3	1.0900	820
5	2.0620	331	5	1.0594	822
13	2.0090	420	3	1.0379	751
50	1.8350	422	3	1.0308	662
13	1.7290	511	5	1.0048	840
15	1.5890	440	5	0.9867	911
7	1.5190	531	3	0.9807	842
5	1.4980	600	1	0.9581	664
13	1.4210	620	3	0.9422	931
3	1.3710	533	3	0.9173	844
1	1.3550	622	3	0.9033	933
7	1.2971	444	5	0.8815	10,20

BETA POTASSIUM ZIRCONIUM FLUORIDE 2KF.ZRF4

REFERENCES.
ORNL-2548 P56
V.BODE AND G.TEUFER,Z.ANORG.ALLGEM.CHEM.,283,18,(1956)
R.E.THOMA,B.J.STURM AND E.H.GUINN,ORNL-3594

CRYSTAL SYSTEM. ORTHORHOMBIC
A#6.58 B#11.42 C#6.94

OPTICAL PROPERTIES.
NX#1.412 NZ#1.424 BIAXIAL POSITIVE,2V#10
POLYSYNTHETIC TWINNING

THERMAL DATA.
MELTS INCONGRUENTLY TO 3KF.ZRF4 AND LIQUID AT 590 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.7100	020	40	2.0610	151,241,311
60	4.4400	021	35	1.9010	060
10	3.4800	002	30	1.8360	061,331
70	3.3000	130,200	20	1.7380	004
100	2.9760	131	5	1.6570	024,114
10	2.8550	040	5	1.6430	260,400
5	2.6420	041	5	1.6040	261,401
10	2.3840	202	15	1.5840	350,170
45	2.2130	042	5	1.5430	171,351,421
35	2.1490	310		0.	

POTASSIUM ZIRCONIUM FLUORIDE 3KF.2ZRF4

REFERENCES.
ASTM 10-151
ORNL-2548 P56
R.E.THOMA,B.J.STURM AND E.H.GUINN,ORNL-3594

THERMAL DATA.
MELTS INCONGRUENTLY TO 2KF.ZRF4 AND LIQUID AT 412 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	7.3700	85	3.3100
20	6.5600	75	3.1100
75	5.9500	10	2.5710
70	5.5400	15	2.5500
15	5.0900	15	2.2700
25	4.9500	25	2.2140
20	4.9000	65	2.2000
40	4.3900	10	2.1110
100	3.9700	100	1.9790
10	3.8300	10	1.8830
20	3.7100	25	1.8420
20	3.6600	10	1.7390
15	3.5600	20	1.7050
15	3.4500	20	1.6730
100	3.3300		0.

ALPHA POTASSIUM ZIRCONIUM FLUORIDE KF.ZRF4

REFERENCES.
ASTM 10-149
ORNL-2548 P56
R.E.THOMA,B.J.STURM AND E.H.GUINN,ORNL-3594

OPTICAL PROPERTIES.
NX#1.412 NZ#1.428 BIAXIAL NEGATIVE,2V#80

THERMAL DATA.
MELTS CONGRUENTLY AT 487 C
ALPHA-BETA TRANSITION AT 448 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
60	5.8300	5	2.2320
35	4.8900	20	2.2000
80	4.4000	15	2.1400
20	4.2900	10	2.0880
5	4.0700	5	2.0430
100	3.8600	10	2.0160
20	3.0800	5	1.9120
10	2.9000	10	1.8500
5	2.5200	5	1.7790
15	2.4750		0.

BETA POTASSIUM ZIRCONIUM FLUORIDE KF.ZRF4

REFERENCES.
ASTM 10-148
R.E.THOMA,B.J.STURM AND E.H.GUINN,ORNL-3594

OPTICAL PROPERTIES.
NX#1.488 NZ#1.504 BIAXIAL POSITIVE,2V#75

THERMAL DATA.
ALPHA-BETA TRANSITION AT 448 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	8.2600	15	2.3320
50	6.9700	10	2.1790
100	6.3200	10	2.1200
15	5.5000	40	2.1060
30	5.3100	15	2.0650
15	3.9300	10	1.9670
40	3.4900	60	1.9160
35	3.3600	15	1.8650
60	3.2900	35	1.8430
100	3.1500	15	1.7480
5	2.7630	5	1.6650
10	2.7310	70	1.5790
15	2.3920		0.

PRASEODYMIUM (III) FLUORIDE PRF3

REFERENCES.
ASTM 6-0325
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/MCM
A#7.075 C#7.238 Z# 6 DENSITY#6.14

OPTICAL PROPERTIES.
NO#1.614 NE#1.618 UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
36	3.6220	002	12	1.4270	223
37	3.5420	110	9	1.3540	304
100	3.1800	111	7	1.3390	115
10	2.5310	112	12	1.3140	411
51	2.0420	300	6	1.1795	330
42	1.9930	113	10	1.1696	413
30	1.7790	302	8	1.1210	332
21	1.7180	221	7	1.0386	306
5	1.6120	114	1	1.0212	600
4	1.5910	222	9	0.9824	415

RUBIDIUM BERYLLIUM FLUORIDE 3RBF.BEF2

REFERENCES.
ASTM 10-147
ORNL-2548 P 38

THERMAL DATA.
MELTS CONGRUENTLY AT 725 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	3.8300	15	2.0470
10	3.5500	5	1.9870
35	3.4500	10	1.9200
10	3.2100	15	1.8090
10	3.1100	15	1.7990
60	2.9500	40	1.6880
10	2.7550	35	1.5770
5	2.6550	5	1.5310
5	2.6290	100	1.4250
55	2.4880	100	1.4210
5	2.3730	10	1.3280
25	2.1250		0.

RUBIDIUM BERYLLIUM FLUORIDE 2RBF.BEF2

REFERENCES.
ASTM 10-146
ORNL-2548 P 38

OPTICAL PROPERTIES.
N(AVERAGE)#1.391 BIAXIAL POSITIVE,2V#40,
MODERATE BIREFRINGENCE

THERMAL DATA.
MELTS CONGRUENTLY AT 800 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.1000	5	2.3500
20	4.2500	5	2.3380
5	3.9800	25	2.2750
15	3.8200	15	2.2420
10	3.5900	25	2.1250
50	3.4500	5	2.0970
25	3.4000	5	2.0650
30	3.2600	50	2.0470
10	3.2200	10	1.9750
15	3.1100	25	1.9280
100	3.0700	30	1.8970
100	2.9500	25	1.8680
15	2.8220	20	1.7990
10	2.7470	35	1.7300
20	2.6910	15	1.6990
5	2.5920	10	1.6410
90	2.5560	5	1.5990
60	2.4820	20	1.4720
70	2.4230	10	1.4680

RUBIDIUM BERYLLIUM FLUORIDE RBF.BEF2

REFERENCES.
ASTM 10-145
ORNL-2548 P 38
V.ILYUKHIN AND N.BELOV,DOKLADY AKAD.NAUK.S.S.S.R.,140,1066,(1961)

CRYSTAL SYSTEM. TRICLINIC SPACE GROUP. P1 OR P-1
A#4.69 B#4.61 C#6.12 Z# 1 DENSITY#2.809
ALPHA#90.45 BETA#90.33 GAMMA#120.80

OPTICAL PROPERTIES.
N(AVERAGE)#1.332 BIAXIAL,VERY LOW BIREFRINGENCE

THERMAL DATA.
MELTS INCONGRUENTLY TO 2RBF.BEF2 AND LIQUID AT 442

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	6.2800	10	2.3940
20	5.2400	5	2.3670
5	4.7000	15	2.3320
5	4.4900	35	2.3000
20	4.2400	45	2.2750
10	4.1700	15	2.1040
20	3.8500	100	2.0760
45	3.7400	35	2.0520
10	3.6200	10	1.9470
5	3.5800	10	1.9200
100	3.4600	10	1.8830
100	3.3800	10	1.8610
10	3.2600	15	1.8250
10	3.1800	10	1.8020
100	3.1200	15	1.7350
10	3.0300	15	1.7230
15	2.9600	30	1.6990
20	2.8700	10	1.6800
25	2.7390	10	1.6300
5	2.5640	10	1.6140
10	2.5210	10	1.5780
10	2.4960	35	1.5570
5	2.4820	25	1.5520
10	2.4300		0.

COMMENTS.
THE POWDER PATTERN CANNOT BE INDEXED FROM THE CRYSTAL PARAMETERS

RUBIDIUM BERYLLIUM FLUORIDE RBF.2BEF2

REFERENCES.
ASTM 10-143
ORNL-2548 P 38

OPTICAL PROPERTIES.
NX#1.325 NZ#1.333 BIAXIAL NEGATIVE, 2V#70

THERMAL DATA.
MELTS CONGRUENTLY AT 464 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
70	6.1600	10	2.3270
40	3.3900	5	2.2010
20	3.3100	20	2.1490
100	3.1000	5	1.8760
5	2.7150	10	1.8520
35	2.4750	15	1.8190
15	2.4100	15	1.5520

RUBIDIUM CERIUM (III) FLUORIDE RBF.CEF3

OPTICAL PROPERTIES.
NX#1.500 NZ#1.520 BIAXIAL POSITIVE, 2V#75

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
25	5.9100	20	2.6080
25	4.9300	35	2.5220
35	3.6800	60	2.3550
35	3.5800	35	2.2960
50	3.4500	15	2.0880
100	3.3100	15	2.0600
75	3.2400	15	1.9680
50	3.2100	20	1.9430
25	3.0500	40	1.9240

RUBIDIUM CHROMIUM(III) FLUORIDE 3RBF.CRF3

REFERENCES.
ASTM 10-144

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
12	3.4700	20	2.2640
100	3.1600	40	2.2080
55	3.1300	10	2.1490
55	3.1100	10	2.0880
12	2.9800	10	1.8290
15	2.5700	10	1.8130
12	2.4680	25	1.8050
5	2.3500	10	1.6250
10	2.3150	25	1.5820

RUBIDIUM LANTHANUM FLUORIDE RBF.LAF3

REFERENCES.
ASTM 10-142
E.P.DERGUNOV,DOKLADY AKAD.NAUK.S.S.S.R.,60,1185,(1948)

CRYSTAL SYSTEM. TETRAGONAL(PSEUDO)
A#8.11 C#6.5

OPTICAL PROPERTIES.
NX#1.498 NZ#1.519 BIAXIAL POSITIVE,2V#70

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
25	8.1100	100	15	1.9300	401
15	5.0700	101	40	1.9000	330
8	5.0500	200	12	1.8700	213
100	3.4300	201	15	1.7100	402
25	2.4800	301	15	1.6800	412
40	2.2500	320	8	1.4600	413
15	1.9700	410		0.	

RUBIDIUM LANTHANUM FLUORIDE 3RBF.LAF3

REFERENCES.
E.P.DERGUNOV,DOKLADY AKAD.NAUK.S.S.S.R.,60,1185,(1948)

OPTICAL PROPERTIES.
N#1.424

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
30	4.9300	20	2.2370
30	3.6600	15	2.2060
20	3.4700	20	2.1840
20	3.4000	40	1.9910
90	3.3000	30	1.9050
60	3.1100	40	1.7010
100	2.8210	20	1.6270
40	2.3440		0.

RUBIDIUM SODIUM BERYLLIUM FLUORIDE RBF.2NAF.BEF2

OPTICAL PROPERTIES.
N#1.374

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
25	4.6000	10	2.1890
85	4.1500	15	1.9870
40	3.7500	5	1.9390
100	2.9900	30	1.8830
100	2.8750	10	1.8720
70	2.7670	25	1.8250
85	2.7400	20	1.7510
20	2.6180	30	1.6820
100	2.4940	25	1.6570
60	2.3620	15	1.5860
30	2.2950	10	1.5690
10	2.2320	30	1.4950

RUBIDIUM SODIUM URANIUM (IV) FLUORIDE RBF.NAF.UF4

REFERENCES.
ASTM 10-178

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P3 OR P-3
A#6.29 C#8.13 Z# 2 DENSITY#5.490

OPTICAL PROPERTIES.
NO#1.484 NE#1.486 UNIAXIAL POSITIVE,PALE GREEN
ANOMALOUS PURPLE INTERFERENCE COLOR

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	8.1200	001	35	1.8380	122
40	5.4400	010	15	1.8140	030
40	4.5100	011	5	1.7710	031
100	3.2500	012	20	1.7070	114
50	3.1400	110	5	1.6390	123
15	2.9300	111	10	1.6260	005,024
15	2.7200	020	10	1.5730	220
5	2.5850	021	5	1.5560	015
10	2.4170	013	3	1.5080	130
50	2.2620	022	5	1.4860	131
15	2.0530	120	5	1.4470	214
15	2.0320	004	15	1.4170	132
10	1.9930	121	10	1.3540	034
5	1.9220	023	10	1.3150	016
15	1.9030	014		0.	

RUBIDIUM SODIUM ZIRCONIUM FLUORIDE RBF.NAF.2ZRF4

REFERENCES.
ASTM 10-127
ORNL-2548 P64

OPTICAL PROPERTIES.
NO#1.446 NE#1.435 UNIAXIAL NEGATIVE .
OFTEN SHOWS PLATEY HABIT

THERMAL DATA.
MELTS CONGRUENTLY AT 462 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	7.4300	5	2.3440
5	6.7100	5	2.2860
5	6.5400	5	2.2370
40	5.9100	10	2.1940
20	4.5500	20	2.1590
5	4.4100	10	2.1420
50	4.1300	5	2.0830
8	3.9000	10	2.0600
60	3.7100	8	1.9830
45	3.5200	12	1.9630
8	3.4000	15	1.9430
100	3.3500	25	1.9350
12	3.2900	5	1.9200
10	3.2300	8	1.8540
12	3.1300	8	1.8360
20	2.8260	40	1.7570
5	2.4810	45	1.7540
5	2.4300	8	1.6940
5	2.3920	40	1.6760
5	2.3800	30	1.6700

RUBIDIUM SODIUM ZIRCONIUM FLUORIDE 3RBF.3NAF.4ZRF4

REFERENCES.
ASTM 10-128

OPTICAL PROPERTIES.
NO#1.436 NE#1.430 UNIAXIAL NEGATIVE

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	6.7700	5	2.9500
15	6.1100	10	2.5710
15	5.7200	8	2.4820
30	5.3700	8	2.3560
9	4.6700	8	2.2430
35	4.2100	10	2.1640
10	4.1100	15	2.1110
15	3.9800	15	2.0880
20	3.8200	35	2.0600
30	3.7200	30	2.0250
5	3.5600	8	2.0040
10	3.5000	8	1.9760
100	3.4400	30	1.9470
8	3.3100	20	1.9090
30	3.2200	85	1.8610
65	3.1700	5	1.8120
100	3.1100	10	1.7270
5	3.0700	10	1.6380
20	3.0100	10	1.5910

RUBIDIUM SODIUM ZIRCONIUM FLUORIDE 3RBF.3NAF.2ZRF4

REFERENCES.
ASTM 10-141

THERMAL DATA.
THIS COMPOUND HAS ONLY METASTABLE EXISTENCE IN A SYSTEM OF ITS OWN COMPOSITION.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
55	4.3200	30	2.2810
30	4.1500	25	2.1640
20	3.5700	10	2.1250
20	3.3300	30	2.0790
55	3.2200	15	1.9200
15	3.0900	30	1.8680
100	3.0000	15	1.7670
10	2.7470	25	1.7420
10	2.4810	25	1.5000
10	2.4500		0.

RUBIDIUM SODIUM ZIRCONIUM FLUORIDE RBF.NAF.ZRF4

REFERENCES.
ORNL-2548 P64,ASTM 10-126

OPTICAL PROPERTIES.
NX#1.385 NZ#1.395 BIAXIAL NEGATIVE,2V#60
FIBROUS OR PLATEY,POLYSYNTHETIC AND RECTANGULAR TWINNING

THERMAL DATA.
MELTS CONGRUENTLY AT 642 C

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.2100	10	2.5710
5	4.8200	8	2.5140
40	4.6800	15	2.3500
45	4.2100	30	2.3320
15	3.7500	30	2.3210
5	3.6500	100	2.1520
10	3.5900	100	2.0940
65	3.3900	10	1.8860
10	3.3400	20	1.7630
20	3.2900	10	1.6140
35	3.2400		0.

RUBIDIUM THORIUM FLUORIDE 5RBF.THF4

REFERENCES.
ORNL-2548,P76

OPTICAL PROPERTIES.
NX#1.423 NZ#1.431 BIAXIAL NEGATIVE,2V#70

THERMAL DATA.
SUBSOLIDUS COMPOUND UNSTABLE ABOVE 548 C
WITH RESPECT TO RBF AND 7RBF.2THF4.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
45	6.9100	10	3.1100
40	5.9400	5	3.0000
25	5.6800	5	2.6540
25	5.0600	55	2.3640
15	4.0900	10	2.1090
15	3.7200	30	1.9900
25	3.5400	60	1.9510
95	3.4400	5	1.8400
25	3.3400	15	1.7260
100	3.2400	20	1.6850

ALPHA RUBIDIUM THORIUM FLUORIDE 7RBF.2THF4

REFERENCES.
ORNL-2548,P76

OPTICAL PROPERTIES.
N(AVERAGE)#1.418 VERY LOW BIREFRINGENCE
POLYSYNTHETIC TWINNING

THERMAL DATA.
MELTS INCONGRUENTLY TO 3RBF.THF4 AND LIQUID AT 890 C.
ALPHA-BETA TRANSITION AT 680 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
W	7.5300	M-S	2.1730
M	5.6800	VW	1.9920
M	5.4100	M	1.9550
M	5.0800	VW	1.9050
W	4.3600	VW	1.8840
M	3.7700	M	1.8370
M	3.4300	W	1.8150
VW	3.3900	VW	1.7830
S	3.3100	VW	1.7280
VW	3.2500	VW	1.7000
VW	3.0800	VW	1.6490
VW	2.9420	W	1.4520
W	2.8220	W	1.3920
VW	2.7020	W	1.3470
VW	2.6260	VW	1.2900
M	2.5380	VW	1.2580
W	2.3780	VW	1.2080
VW	2.2670	VW	1.1780

BETA RUBIDIUM THORIUM FLUORIDE 7RBF.2THF4

REFERENCES.
ORNL-2548,P76

OPTICAL PROPERTIES.
NO#1.428 NE#1.435 UNIAXIAL POSITIVE
POLYSYNTHETIC TWINNING

THERMAL DATA.
ALPHA-BETA TRANSITION AT 680 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
W	6.0000	VW	2.4560
W	5.6200	VW	2.4210
W	5.5100	M	2.3830
W	5.2900	W	2.3340
VW	4.9000	W	2.0900
VW	4.4900	W	2.0060
W	3.5000	M	1.9500
S	3.3970	M	1.7260
M	3.3220	M	1.6960

RUBIDIUM THORIUM FLUORIDE 3RBF.THF4

REFERENCES.
E.P.DERGUNOV AND A.G.BERGMAN
DOKLADY AKAD.NAUK.S.S.S.R.,60,391,(1948)

CRYSTAL SYSTEM. CUBIC
A#9.62

OPTICAL PROPERTIES.
N#1.427

THERMAL DATA.
MELTS CONGRUENTLY AT 974 C.
METASTABLE BELOW 485 C WITH RESPECT TO 7RBF.2THF4 AND 2RBF.THF4

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
40	5.5900	111	45	1.9590	500
100	3.2400	300	15	1.6770	322
25	2.4040	400	15	1.5150	450

RUBIDIUM THORIUM FLUORIDE 2RBF.THF4

REFERENCES.
L.A.HARRIS,ACTA CRYST.,13,502,(1960)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. C-62M
A#6.85 C#3.83 Z# 1 DENSITY#5.56

OPTICAL PROPERTIES.
NO#1.470 NE#1.494 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 870 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
95	5.9000	010	100	1.9340	121
20	3.5300	NI	10	1.8230	012
100	3.4200	110	5	1.7540	031
5	3.2700	NI	5	1.7290	NI
100	3.2200	011	25	1.7110	220
35	2.9600	020	30	1.6710	112
10	2.5500	111	10	1.6430	310
5	2.4790	NI	5	1.6120	022
85	2.3460	021	40	1.5110	311
15	2.2390	120	15	1.3810	041
100	1.9750	030		0.	

RUBIDIUM THORIUM FLUORIDE 7RBF.6THF4

REFERENCES.
ORNL-2548,P76

CRYSTAL SYSTEM. RHOMBOHEDRAL
A#9.58 ALPHA#106.91 Z# 1 DENSITY#5.84

OPTICAL PROPERTIES.
NO#1.486 NE#1.482 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 852 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
20	8.3900	100	5	2.0470	113
5	7.6600	1-10	5	2.0210	4-31
10	5.7000	11-1	20	1.8680	14-4
10	4.9800	110	30	1.8520	104
15	4.6000	2-10	5	1.7990	3-43
10	4.4800	11-2	10	1.7670	2-53
2	4.1900	200	5	1.5380	05-5
10	3.8900	2-20	2	1.4720	0-46
5	3.6800	21-1	5	1.4260	44-3
30	3.6000	111	5	1.4140	304
100	3.5300	2-21	15	1.4030	3-35
5	3.1800	11-3	20	1.3830	15-6
55	3.0710	1-30	5	1.3690	-116
2	2.9380	2-30	5	1.3630	44-5
5	2.3810	11-4	5	1.2700	-635
5	2.2740	20-4	2	1.2670	1-66
25	2.1840	23-3	5	1.2530	-162
60	2.1550	0-34	10	1.2480	-1-57
5	2.1300	13-4		0.	

COMMENTS.
THE 7-6 RUBIDIUM,POTASSIUM AND SODIUM COMPOUNDS WITH
URANIUM AND THORIUM ARE ISOMORPHOUS
THE HEXAGONAL AXES ARE A#15.39 C#10.73

RUBIDIUM THORIUM FLUORIDE RBF.3THF4

REFERENCES.
E.P.DERGUNOV AND A.G.BERGMAN
DOKLADY AKAD.NAUK.S.S.S.R.,60,391,(1948)

OPTICAL PROPERTIES.
NX#1.535 NZ#1.540 BIAXIAL POSITIVE,2V#30

THERMAL DATA.
MELTS INCONGRUENTLY TO RBF.6THF4 AND LIQUID AT 920 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
60	8.2600	10	2.4570
20	7.4900	15	2.3880
15	6.9600	10	2.1990
30	5.7000	20	2.1350
10	5.5300	20	2.0830
30	4.6700	40	2.0630
25	4.3500	45	2.0470
30	4.2400	45	1.9960
10	4.1700	20	1.9160
20	4.1100	15	1.8830
40	3.8400	15	1.8500
65	3.7500	20	1.7960
100	3.6000	25	1.7570
10	3.4800	10	1.6770
70	3.4300	10	1.6300
55	3.3200	10	1.5740
20	3.1600	20	1.4770
45	2.9900	15	1.4600
10	2.9470	5	1.4200
15	2.7690	5	1.3990
15	2.6960	10	1.3860
10	2.6270		0.

RUBIDIUM THORIUM FLUORIDE RBF.6THF4

REFERENCES.
ORNL-2548,P76

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P3121
A#8.33 C#25.40

OPTICAL PROPERTIES.
NO#1.530 NE#1.526 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO THF4 AND LIQUID AT 995 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	8.4700	003	75	2.0830	220
40	6.9400	011	20	2.0310	01.12
30	4.7700	014	10	1.9920	131
100	4.2300	006	25	1.9430	02.11
35	4.1700	110	20	1.8830	01.13
85	3.5700	021	40	1.8680	226
20	3.4700	022	20	1.7990	401
10	3.2400	017	10	1.7860	042
35	3.1400	024	5	1.7480	03.10
20	2.9660	116	10	1.6970	00.15
50	2.9430	025	20	1.6740	12.12
10	2.5540	027	5	1.6130	22.10
10	2.5060	124	10	1.5730	31.10
15	2.4020	125	10	1.4810	11.16
10	2.3840	028	10	1.4690	40.10
20	2.1160	00.12	10	1.4650	01.17

COMMENTS.
THE SPACE GROUP IS ONE OF THE FOUR ENTANTIOMORPHS P3121,P3112, P3212 OR P3221.

RUBIDIUM URANIUM (III) FLUORIDE 3RBF.UF3

CRYSTAL SYSTEM. CUBIC
A#9.570

OPTICAL PROPERTIES.
N#1.440 PINKISH-BROWN

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	5.5400	111	10	2.1390	420
20	4.7800	200	40	1.9530	422
100	3.3800	220	10	1.8430	333
20	2.8810	311	5	1.6180	531
50	2.3930	400	5	1.5940	600
10	2.1940	331	10	1.5140	620

RUBIDIUM URANIUM (IV) FLUORIDE 3RBF.UF4

REFERENCES.
ASTM 10-140
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)

CRYSTAL SYSTEM. CUBIC
A#9.5667

OPTICAL PROPERTIES.
N#1.438

THERMAL DATA.
MELTS CONGRUENTLY AT 995 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.5243	111	95	1.9552	422
55	4.7918	200	20	1.8415	333
100	3.3793	220	20	1.6923	440
35	2.8823	311	20	1.6182	531
50	2.3932	400	10	1.5960	600
15	2.1943	331	25	1.5131	620
25	2.1396	420		0.	

RUBIDIUM URANIUM (IV) FLUORIDE 2RBF.UF4

REFERENCES.
ASTM 10-138
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)

OPTICAL PROPERTIES.
NX#1.473 NZ#1.487 BIAXIAL POSITIVE,2V#70
X#LIGHT GREEN,Z#LIGHT VIOLET,POLYSYNTHETIC TWINNING

THERMAL DATA.
MELTS INCONGRENTLY TO 3RBF.UF4 AND LIQUID AT 818 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
15	6.0300	10	1.9630
100	4.7500	35	1.9470
25	3.4900	5	1.9090
10	3.2300	15	1.7400
20	3.1700	15	1.6990
10	3.0200	15	1.6730
20	2.8140	25	1.6350
10	2.3670	5	1.5840
10	2.2810	5	1.5380
45	2.1840	5	1.5110
65	2.0080	10	1.4760

RUBIDIUM URANIUM (IV) FLUORIDE 7RBF.6UF4

REFERENCES.
ASTM 10-137
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)
L.A.HARRIS,ORNL CF 58-3-15(1958)

CRYSTAL SYSTEM. RHOMBOHEDRAL
A#9.595 ALPHA#107.67 Z# 1 DENSITY#6.02

OPTICAL PROPERTIES.
NO#1.518 NE#1.512 UNIAXIAL NEGATIVE,GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO RBF.UF4 AND LIQUID AT 675 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
15	8.3500	101	25	2.1690	134
15	4.9800	012	50	2.1400	520
15	4.5700	211	7	2.0300	205
7	4.4600	300	15	1.8900	434,603
5	4.1700	202	15	1.8540	315
10	3.8500	220	45	1.8350	244
20	3.5800	122	7	1.7860	006,514
100	3.5100	131,003	20	1.7510	235,262
45	3.0500	312	15	1.5220	624
7	2.2590	413		0.	

COMMENTS.
HEXAGONAL INDEXING
THE 7-6 RUBIDIUM,POTASSIUM AND SODIUM COMPOUNDS WITH
URANIUM AND THORIUM ARE ISOMORPHOUS
THE HEXAGONAL AXES ARE A#15.49 C#10.42

RUBIDIUM URANIUM (IV) FLUORIDE RBF.UF4

REFERENCES.
ASTM 10-139
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)

OPTICAL PROPERTIES.
NX#1.512 NZ#1.527 BIAXIAL NEGATIVE,2V#70
X#GREEN,Z#BLUE,MARKED DISPERSION OF THE OPTIC AXES
POLYSYNTHETIC TWINNING,ANGLE Y-C#20,LATH-SHAPED CRYSTALS

THERMAL DATA.
MELTS CONGRUENTLY AT 735 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	8.2600	5	2.3150
10	7.5600	20	2.2860
100	6.8600	10	2.2010
15	4.4400	5	2.1640
15	4.0200	5	2.1300
10	3.9600	5	2.0080
5	3.8500	30	1.9870
5	3.7900	5	1.9160
10	3.5600	10	1.9010
50	3.4600	5	1.8650
100	3.4300	5	1.8500
5	3.2500	5	1.8290
10	3.0400	5	1.7330
5	2.6300	25	1.7140
10	2.6070	5	1.5790
10	2.5270	5	1.5180

RUBIDIUM URANIUM (IV) FLUORIDE 2RBF.3UF4

REFERENCES.
ASTM 10-136
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)

OPTICAL PROPERTIES.
NX#1.542 NZ#1.550 BIAXIAL NEGATIVE,2V#60
INCLINED EXTINCTION,PLEOCHROIC-BLUISH GREEN AND
PALE VIOLET-GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO RBF.3UF4 AND LIQUID AT 722 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	6.3900	10	2.4170
45	5.8000	10	2.3610
5	5.0400	25	2.2590
5	4.1800	30	2.1840
40	3.8600	60	2.0380
100	3.5000	10	1.9430
15	3.2200	5	1.9350
5	3.0700	10	1.8430
10	2.7800	10	1.8050
15	2.6140	5	1.7730

RUBIDIUM URANIUM (IV) FLUORIDE RBF.3UF4

REFERENCES.
ASTM 10-135
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)

OPTICAL PROPERTIES.
NX#1.588 NZ#1.598 BIAXIAL POSITIVE,2V#70
YELLOW-GREEN,STRONG DISPERSION OF THE OPTIC AXES.
ANOMALOUS DISPERSION OF BIREFRINGENCE IN PURPLISH-RED

THERMAL DATA.
MELTS INCONGRUENTLY TO RBF.6UF4 AND LIQUID AT 730 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
60	7.9700	15	2.5710
10	7.6300	10	2.5010
15	7.3100	10	2.4690
10	6.7100	5	2.4330
5	6.3200	15	2.4040
5	5.8000	15	2.3410
10	5.5700	5	2.3150
20	5.5000	15	2.2470
10	5.3800	15	2.2370
10	5.0100	40	2.2160
30	4.5500	20	2.1590
15	4.4100	5	2.1110
5	4.3100	20	2.0880
25	4.2300	10	2.0700
15	4.1500	15	2.0430
5	4.0900	20	2.0340
10	4.0400	80	2.0250
20	3.9900	100	2.0020
25	3.8800	60	1.9510
40	3.7300	10	1.9030
55	3.6600	10	1.8830
15	3.5900	40	1.8700
100	3.5200	15	1.8470
10	3.4300	30	1.8310
80	3.3600	10	1.8090
35	3.3400	10	1.7890
60	3.2400	25	1.7570
35	3.1000	35	1.7200
5	3.0000	25	1.6590
5	2.9800	10	1.6140
40	2.9000	20	1.5940
10	2.8480	15	1.5890
10	2.7360	5	1.5770
20	2.7060	10	1.5640
10	2.6670	20	1.5500
20	2.6290		0.

RUBIDIUM URANIUM (IV) FLUORIDE RBF.6UF4

REFERENCES.
ASTM 10-134
R.E.THOMA,ET.AL.,J.AM.CERAM.SOC.,41,538,(1958)
L.A.HARRIS,ORNL CF-58-5-63

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. C6/MMC
A#8.195 C#16.37 Z# 2 DENSITY#6.908

OPTICAL PROPERTIES.
NO#1.594 NE#1.586 UNIAXIAL NEGATIVE,GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO UF4 AND LIQUID AT 832 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
15	7.1400	100	5	2.3670	300
20	6.5300	101	15	2.2700	116,302
30	4.3500	103	20	2.1720	30-3,206
75	4.1300	004,110	75	2.0490	304,220
20	3.9300	111	10	2.0300	117,221
10	3.6800	112	20	2.0060	222
50	3.5500	104,200	45	1.9570	20-7,311
100	3.4700	201	40	1.8330	1-28,224
10	3.3000	113	20	1.7630	401
10	3.2200	202	15	1.6880	135
60	2.9800	105,203	10	1.6410	00 10,226
25	2.9000	114	10	1.6300	218,320
10	2.7470	006	5	1.6200	209,231
20	2.6860	204,120	5	1.6060	01 10
15	2.4100	205,213		0.	

RUBIDIUM ZIRCONIUM FLUORIDE 3RBF.ZRF4

REFERENCES.
ASTM 10-133
ORNL-2548 P 57

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#9.31

THERMAL DATA.
MELTS CONGRUENTLY AT 897 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2900	220	100	1.9000	224
60	2.3260	400	20	1.6460	440

BETA RUBIDIUM ZIRCONIUM FLUORIDE 2RBF.ZRF4

REFERENCES.
ASTM 10-132
V.BODE AND G.TEUFER,Z.ANORG.ALLGEM.CHEM.,283,18,(1956)
ORNL-2548 P 57

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-3M1
A#6.16 C#4.82 Z# 1 DENSITY#3.943

THERMAL DATA.
ALPHA-BETA TRANSITION AT 460 C.

XRAY DATA.

I/I CAL	D-CAL	HKL	I/I CAL	D-CAL	HKL
30	5.3340	100	10	1.7780	300
10	4.8200	001	5	1.6070	003
100	3.5760	101	15	1.5470	122
70	3.0800	110	10	1.5400	220
5	2.6670	200	10	1.4250	113
10	2.5950	111	10	1.4140	131
30	2.3340	021	5	1.2850	401
25	2.1960	012	10	1.2610	312
5	2.0160	210	5	1.2570	123
30	1.8600	121	5	1.1860	321
10	1.7880	202	5	0.9868	241

COMMENTS.
SYNTHETIC POWDER PATTERN CALCULATED FROM STRUCTURE

RUBIDIUM ZIRCONIUM FLUORIDE 5RBF.4ZRF4

REFERENCES.
ASTM 10-131
ORNL-2548 P 57

OPTICAL PROPERTIES.
NX#1.442 NZ#1.452 BIAXIAL NEGATIVE,2V#85

THERMAL DATA.
MELTS CONGRUENTLY AT 445 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.8700	10	2.3860
10	5.6100	75	2.3500
10	5.0400	10	2.2810
15	4.7700	10	2.2750
10	4.5000	10	2.2600
65	4.2900	10	2.2530
25	3.9800	10	2.2450
30	3.8200	10	2.2260
15	3.7800	45	2.1520
15	3.7200	10	2.0670
30	3.6300	10	2.0270
95	3.5900	30	1.9590
10	3.5200	30	1.9320
100	3.4400	15	1.8970
100	3.4200	20	1.8680
100	3.3600	20	1.8330
100	3.2900	30	1.7700
10	3.0500	30	1.7630
25	2.6000	10	1.6790
30	2.5080		0.

ALPHA RUBIDIUM ZIRCONIUM FLUORIDE RBF.ZRF4

REFERENCES.
ASTM 10-130
ORNL-2548 P 57

THERMAL DATA.
MELTS CONGRUENTLY AT 423 C.
ALPHA-BETA TRANSITION AT 391 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
40	7.1300	10	2.2260
20	5.9500	10	2.1840
10	4.2800	10	2.1490
10	4.0200	10	2.1180
80	3.8300	25	2.0560
25	3.6900	10	1.9910
5	3.5900	25	1.9570
100	3.4500	10	1.9280
100	3.4200	20	1.9050
100	3.3400	15	1.8680
15	3.0700	15	1.8120
10	3.0100	10	1.7820
10	2.6990	10	1.7630
10	2.6220	10	1.7420
20	2.5740	15	1.6700
5	2.5500	10	1.6110
10	2.4500	10	1.5470
25	2.4230	15	1.5020
15	2.3270		0.

BETA RUBIDIUM ZIRCONIUM FLUORIDE RBF.ZRF4

REFERENCES.
ASTM 10-129
ORNL-2548 P 57

OPTICAL PROPERTIES.
NX#1.500 NZ#1.509 BIAXIAL NEGATIVE,2V#75
LATH-LIKE,ELONGATE NEGATIVE,EXTINCTION ABOUT 2 DEGREES

THERMAL DATA.
ALPHA-BETA TRANSITION AT 391 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	7.3700	10	2.3550
40	6.6600	10	2.3440
5	6.3200	5	2.3090
5	5.5300	10	2.2920
5	5.1700	5	2.2530
20	5.0100	10	2.2400
5	4.6700	15	2.2110
5	4.5400	15	2.2060
5	4.4600	30	2.1910
10	4.3500	40	2.1160
10	3.9900	10	2.0740
5	3.8800	5	2.0340
30	3.7700	30	1.9970
35	3.7200	50	1.9890
40	3.6900	50	1.9350
40	3.6100	50	1.9290
100	3.4200	55	1.9260
100	3.3600	30	1.9030
100	3.3250	5	1.8940
10	3.0900	10	1.8720
15	3.0600	10	1.8570
5	2.9600	10	1.8360
5	2.9000	5	1.7730
5	2.8220	5	1.7570
40	2.7880	5	1.7510
45	2.7670	5	1.7420
5	2.6780	15	1.7310
5	2.6140	15	1.7280
5	2.5640	25	1.7190
10	2.5140	15	1.7160
10	2.5010	15	1.7090
5	2.4820	10	1.6990
5	2.4550	10	1.6940
5	2.4330	20	1.6790
5	2.4230	5	1.6620
5	2.3980	20	1.6540
10	2.3800		0.

SAMARIUM (II) FLUORIDE SMF2

CRYSTAL SYSTEM. CUBIC
A#5.79

OPTICAL PROPERTIES.
N#1.632,BLOOD RED

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.3200	111	20	1.3300	331
40	2.8800	200	5	1.2950	420
60	2.0470	220	10	1.1840	422
40	1.7450	311		0.	

SAMARIUM (III) FLUORIDE SMF3

REFERENCES.
ASTM 5-0517
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).
E.STARIZKY AND L.B.ASPREY, ANAL.CHEM.29,857,(1957)

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.669 B#7.059 C#4.405 Z# 4 DENSITY#6.643

OPTICAL PROPERTIES.
NX#1.577 NY#1.597 NZ#1.608 BIAXIAL NEGATIVE,2V#72
X#C,Y#B,Z#A,TWINNED ON (101),ANGLE Z-(101)#67

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
20	3.7200	011	20	1.5900	141
50	3.6800	101	20	1.5600	132
50	3.5700	020	5	1.5300	312
100	3.2500	111	5	1.5100	331
100	3.0100	210	50	1.4500	232
20	2.5400	121	20	1.4400	013
20	2.2000	002	20	1.3800	042
50	2.1200	221	5	1.3400	203
50	2.0000	112	50	1.3200	341
100	1.9800	301,131	20	1.3000	250
50	1.9200	230	50	1.2600	511,223
20	1.9100	311	20	1.2400	422
20	1.8600	022	20	1.2100	440
50	1.8000	122	20	1.2000	521
20	1.7700	212	50	1.1800	060
20	1.7600	040	20	1.1700	152
50	1.7300	321	51	0.3300	123
20	1.6600	400		0.	

SCANDIUM FLUORIDE SCF3

REFERENCES.
W.NOWACKI, Z.KRIST.,101,275,(1939)

CRYSTAL SYSTEM. RHOMBOHEDRAL SPACE GROUP. R-3C OR R3C
A#4.012 ALPHA#90.05 Z# 1 DENSITY#2.62

OPTICAL PROPERTIES.
N#1.400

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.9950	100	30	1.1130	230
20	2.8300	110	5	1.0730	123
95	2.0030	200	10	1.0040	400
65	1.7940	120	5	0.9739	140
5	1.6380	112	5	0.9464	114,330
25	1.4180	220	5	0.8979	240
15	1.3380	300	10	0.8764	124
5	1.2690	130	5	0.8564	332
5	1.1590	222		0.	

COMMENTS.
THE DEVIATION OF THE RHOMBOHERAL ANGLE CAN BE DETECTED BY CAREFUL COMPARISON OF PRECESSION PHOTOGRAPHS.THE 2-41,-241 24-1 AND 124 REFLECTIONS ARE UNRESOLVED ON A SLOW SCAN,FINE SLIT DIFFRACTOMETER PATTERN.THESE ARE STRONG REFLECTIONS NEAR 124 DEGREES TWO THETA.
THE SCF3 PARAMETERS ARE FROM SINGLE CRYSTALS GROWN FROM THE VAPOR PHASE.

SODIUM BERYLLIUM FLUORIDE NAF.BEF2

REFERENCES.
ASTM 11-569

OPTICAL PROPERTIES.
NX#1.314 NZ#1.319 BIAXIAL POSITIVE,2V#LARGE,PLEOCHROIC
LENGTH SLOW,NX-BROWN,NZ-BLUE

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
95	7.3700	40	2.2600
20	5.2700	100	2.2400
5	4.5100	35	2.1200
5	4.0900	5	2.0500
95	3.7000	10	1.9600
10	3.5600	55	1.9200
95	3.4100	5	1.8800
5	3.2900	100	1.8500
95	3.2200	20	1.8300
10	3.1300	10	1.7900
60	2.9900	10	1.7800
80	2.8900	20	1.7500
20	2.6400	30	1.7100
10	2.4700	10	1.6710
30	2.3900	25	1.6650
50	2.2700	30	1.5960

SODIUM BERYLLIUM THORIUM FLUORIDE NAF.BEF2.3THF4

REFERENCES.
R.E.THOMA ET AL, J.AM.CERAM.SOC.,43,608,(1960)

CRYSTAL SYSTEM. TETRAGONAL
A#11.81 C#10.27

OPTICAL PROPERTIES.
NO#1.544 NE#1.552 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS SEMICONGRUENTLY TO THF4 AND LIQUID AT 745 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
25	5.1400	002	55	2.0510	005
10	4.7000	121	50	2.0270	015
100	4.1900	220	10	1.9680	060
80	3.9400	030	30	1.9180	125
55	3.7200	130	25	1.8670	260
10	3.4100	003	50	1.8410	244
55	3.2800	230	10	1.7820	443
55	3.1700	113	10	1.6750	116
20	2.9600	023	5	1.6000	271
30	2.8700	140	10	1.5610	642
20	2.7900	330	20	1.5520	435
20	2.5850	033	20	1.4640	180
10	2.5110	014	15	1.4250	027
10	2.3440	242	10	1.4120	165
10	2.1960	143	15	1.3750	037
50	2.0940	243		0.	

SODIUM BERYLLIUM URANIUM FLUORIDE NAF.BEF2.3UF4

REFERENCES.
R.E.THOMA ET AL, J.AM.CERAM.SOC.,43,608,(1960)

CRYSTAL SYSTEM. TETRAGONAL
A#11.63 C#10.09

OPTICAL PROPERTIES.
NO#1.598 NE#1.608 UNIAXIAL POSITIVE,GREEN

THERMAL DATA.
MELTS SEMICONGRUENTLY AT 548 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
25	5.0500	002	5	2.3070	242
10	4.6200	121	10	2.1510	224
100	4.1200	220	20	2.0580	440
60	3.8800	030	25	2.0230	005
40	3.6800	130	30	2.0140	441
5	3.3600	003	40	1.9930	350
45	3.2200	230	10	1.6460	116
30	3.1100	113	10	1.5260	614
35	2.9100	023	20	1.4390	081
30	2.8200	140	10	1.4000	027
15	2.7390	330	10	1.3890	127
15	2.5360	033	10	1.3510	455

SODIUM CERIUM (III) FLUORIDE NAF.CEF3

REFERENCES.
ASTM 10-123
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
C.J.BARTON ET AL, J.INORG.NUCL.CHEM.,20,45,(1961)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#6.131 C#3.776 Z#3/2 DENSITY#4.845

OPTICAL PROPERTIES.
NO#1.493 NE#1.514 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO CEF3 AND LIQUID AT 810 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
65	5.3100	100	5	1.8880	002
100	3.0700	110,101	60	1.7710	121,300
10	2.6550	020	10	1.6080	112
15	2.3800	111	5	1.6030	031
25	2.1720	021	5	1.5390	022
5	2.0060	120	20	1.3720	131

SODIUM CHROMIUM (III) FLUORIDE 3NAF.CRF3

OPTICAL PROPERTIES.
N(AVERAGE)#1.411 BIAXIAL

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.1000	20	2.1900
65	4.6200	10	2.1300
45	4.4800	10	2.0700
100	3.9400	10	2.0600
10	3.6200	75	1.9750
35	2.8500	10	1.8600
80	2.7900	20	1.7900
20	2.7400	15	1.7700
10	2.6700	15	1.7500
20	2.4700	10	1.6700
25	2.4100	25	1.6300
30	2.3600	15	1.6200
30	2.3100	40	1.6000

SODIUM CHROMIUM (III) FLUORIDE 5NAF.3CRF3

REFERENCES.
ASTM 10-124

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	3.0100	25	2.0390
10	2.5930	50	1.8420
10	2.1890		0.

COMMENTS.
PREPARED BY B. STURM

SODIUM CHROMIUM (III) ZIRCONIUM FLUORIDE NAF.CRF2.2ZRF4

REFERENCES.
ORNL 2274 P101

OPTICAL PROPERTIES.
N(AVERAGE)#1.456 BIAXIAL NEGATIVE
POLYSYNTHETIC TWINNING

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
40	5.2100	15	2.6220
15	4.5000	25	2.1940
100	4.0600	25	2.0340
10	3.8600	15	2.0160
50	3.4800	15	1.9510
30	3.4300	15	1.7700
45	3.3100	20	1.7390

BETA SODIUM DYSPROSIUM (III) FLUORIDE NAF.DYF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/M AND P-6
A#5.985 C#3.554 Z#3/2 DENSITY#5.907

OPTICAL PROPERTIES.
NO#1.486 NE#1.510 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 835 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.1700	100	15	1.7740	002
70	2.9900	110	45	1.7270	300
70	2.9300	101	40	1.7150	211
25	2.5870	200	20	1.6800	102
20	2.2850	111	30	1.5280	112
90	2.0900	201	15	1.3340	311
15	1.9560	210	5	1.2400	302

COMMENTS.
CRYSTALS OF NAF.DYF3 HAVE BEEN FOUND WHICH FIT BOTH SPACE GROUPS

ALPHA SODIUM DYSPROSIUM (III) FLUORIDE 5NAF.9DYF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.547

OPTICAL PROPERTIES.
N#1.497

THERMAL DATA.
ALPHA-BETA TRANSITION 737 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.1900	111	20	1.3850	400
50	2.7660	200	20	1.2720	331
50	1.9570	220	35	1.1320	422
50	1.6700	311	10	1.0680	511
10	1.5990	222	15	0.9380	531

BETA SODIUM ERBIUM (III) FLUORIDE NAF.ERF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#5.959 C#3.514 Z#3/2 DENSITY#6.137

OPTICAL PROPERTIES.
NO#1.482 NE#1.504 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 702 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.1300	100	15	1.5120	112
100	2.9700	110	10	1.4890	220
75	2.9000	101	10	1.3250	311
10	2.5760	200	5	1.3050	212
10	2.2660	111	5	1.2290	302
60	2.0760	201	10	1.1100	312
10	1.9470	210	5	1.0040	213
10	1.7560	002	5	0.9485	412
25	1.7190	300	5	0.9398	421
50	1.7030	211	5	0.9067	313
5	1.6610	102		0.	

ALPHA SODIUM ERBIUM (III) FLUORIDE 5NAF.9ERF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.514

OPTICAL PROPERTIES.
N#1.492

THERMAL DATA.
ALPHA-BETA TRANSITION 682 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.1700	111	10	1.2320	420
50	2.7500	200	35	1.1250	422
50	1.9090	220	10	1.0610	511
50	1.6620	311	15	0.9748	440
10	1.5900	222	15	0.9323	531
20	1.3770	400	10	0.8718	620
20	1.2650	331		0.	

BETA SODIUM EUROPIUM (III) FLUORIDE NAF.EUF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#6.044 C#3.613 Z#3/2 DENSITY#5.469

OPTICAL PROPERTIES.
NO#1.492 NE#1.516 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 819 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.2200	100	35	1.7450	030
100	3.0200	110	70	1.7360	102
95	2.9700	101	35	1.7350	121
15	2.6110	200	10	1.5500	112
75	2.1180	201	10	1.5110	220
10	1.9770	120	15	1.4520	310
10	1.8050	002	10	1.2570	302

ALPHA SODIUM EUROPIUM (III) FLUORIDE 5NAF.9EUF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.627

OPTICAL PROPERTIES.
N#1.504

THERMAL DATA.
METASTABLE BELOW 806 C WITH RESPECT TO BETA-NAF.EUF3 AND EUF3.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2300	111	50	1.6970	311
50	2.8030	200	10	1.6430	222
50	1.9880	220	20	1.2920	400

ALPHA SODIUM GADOLINIUM (III) FLUORIDE NAF.GDF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.518 Z# 2 DENSITY#5.507

OPTICAL PROPERTIES.
N#1.476

THERMAL DATA.
ALPHA-BETA TRANSITION 832 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.1700	111	20	1.2650	331
50	2.7530	200	35	1.1270	422
50	1.9510	220	10	1.0630	511
50	1.6630	311	15	0.9748	440

BETA SODIUM GADOLINIUM (III) FLUORIDE NAF.GDF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#6.020 C#3.601 Z#3/2 DENSITY#5.647

OPTICAL PROPERTIES.
NO#1.483 NE#1.507 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 832 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
95	5.2100	100	100	2.1150	201
95	3.0100	110	10	1.9680	210
100	2.9760	101	15	1.7300	030,121
5	2.6030	200	80	1.7130	012
35	2.3140	111	5	1.5530	112

ALPHA SODIUM GADOLINIUM (III) FLUORIDE 5NAF.9GDF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.594

OPTICAL PROPERTIES.
N#1.500

THERMAL DATA.
METASTABLE BELOW 755 C WITH RESPECT TO BETA-NAF.GDF3 AND GDF3.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2100	111	35	1.1420	422
50	2.7940	200	10	1.0760	511
50	1.9730	220	15	0.9890	440
50	1.6820	311	15	0.9456	531
10	1.6120	222	10	0.9330	600
20	1.2810	331	10	0.8849	620
10	1.2500	420	10	0.8530	533

SODIUM HAFNIUM FLUORIDE 3NAF.HFF4

REFERENCES.
ASTM 10-156
ORNL-2548 P 70

CRYSTAL SYSTEM. HEXAGONAL
A#6.1 C#10.84

OPTICAL PROPERTIES.
NX#1.378 NZ#1.382 BIAXIAL NEGATIVE,2V#40

THERMAL DATA.
MELTS CONGRUENTLY AT 863 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
55	5.2700	100	10	1.8830	204
90	4.7500	101	75	1.8720	212
50	3.7700	102	15	1.7700	115
100	3.0700	110	50	1.6030	214
40	2.9400	111	5	1.5860	303
30	1.9670	211		0.	

BETA SODIUM HAFNIUM FLUORIDE 5NAF.2HFF4

REFERENCES.
ORNL-2548 P 70

OPTICAL PROPERTIES.
NX#1.393 NZ#1.402 BIAXIAL NEGATIVE,2V#40

THERMAL DATA.
ALPHA-BETA TRANSITION 535 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
25	7.7600	15	2.4090
20	5.7100	10	2.2960
5	5.3700	5	2.2410
80	4.9400	10	2.1160
30	4.7700	10	2.0830
30	4.4600	25	1.9750
25	4.3500	45	1.8970
60	4.1600	5	1.8570
50	3.9700	25	1.8330
10	3.5800	10	1.7510
5	3.3600	10	1.7080
25	3.2800	10	1.6850
30	3.2400	10	1.6630
5	3.1800	10	1.6490
80	3.1000	10	1.6400
90	3.0500	20	1.5960
35	3.0200	10	1.5860
5	2.8800	10	1.5720
5	2.6100	5	1.5520
10	2.4800		0.

SODIUM HAFNIUM FLUORIDE 2NAF.HFF4

REFERENCES.
ORNL 2274 P100
ORNL-2548 P 70

OPTICAL PROPERTIES.
NX#1.380 NZ#1.386 BIAXIAL POSITIVE,2V#50

THERMAL DATA.
MELTS INCONGRUENTLY TO ALPHA 5NAF.2HFF4 AND LIQUID AT 586 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
30	8.0100	25	2.4050
5	6.3900	10	2.3610
30	5.5400	10	2.3270
100	5.1300	5	2.3010
90	4.8000	10	2.2420
20	4.4900	5	2.1940
40	4.3300	10	2.1540
75	3.9900	25	2.0340
90	3.8200	10	2.0080
5	3.5500	10	1.9790
90	3.2400	20	1.9350
20	3.0800	40	1.8980
80	3.0200	15	1.8400
10	2.8800	20	1.8190
5	2.8220	5	1.7920
40	2.7550	10	1.7540
5	2.7060	25	1.7120
20	2.6670	25	1.5990
20	2.5640	15	1.5670
10	2.5290	5	1.5350

COMMENTS.
ADDITIONAL POLYMORPHIC FORMS OF THIS COMPOUND ARE KNOWN.
THEY HAVE NOT BEEN CHARACTERIZED.

SODIUM HAFNIUM FLUORIDE 7NAF.6HFF4

REFERENCES.
ASTM 10-155
ORNL-2548 P 70

OPTICAL PROPERTIES.
NO#1.508 NE#1.500 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO NAF.HFF4 AND LIQUID AT 531 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
30	7.3700	15	2.4900
100	5.6100	40	2.2800
80	5.3700	40	2.2100
15	5.0400	10	2.0300
30	4.3700	10	2.0200
20	4.1700	15	1.9900
45	4.0500	15	1.9500
60	3.9800	60	1.9100
100	3.8700	35	1.8600
10	3.6900	10	1.8400
15	3.4500	10	1.8100
20	3.3500	35	1.7800
15	3.3100	15	1.7300
15	3.2600	40	1.7100
85	3.1300	25	1.6600
20	3.0300	55	1.6500
20	2.8500	65	1.6300
20	2.8200	5	1.6100
15	2.7500	10	1.5800
40	2.7100	15	1.5600
10	2.6200	15	1.5500
35	2.5100		0.

BETA SODIUM HOLMIUM (III) FLUORIDE NAF.HOF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#5.991 C#3.528 Z#3/2 DENSITY#5.994

OPTICAL PROPERTIES.
NO#1.486 NE#1.510 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 752 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.1800	100	90	1.7140	211
70	2.9900	110	5	1.6700	012
70	2.9100	101	10	1.5200	112
25	2.5870	200	15	1.4970	220
20	2.2800	111	5	1.3320	311
90	2.0870	201	5	1.2340	302
15	1.9580	210	5	0.9529	412
10	1.7640	002	5	0.9107	313
25	1.7300	300	5	0.9012	511

ALPHA SODIUM HOLMIUM (III) FLUORIDE 5NAF.9HOF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.537

OPTICAL PROPERTIES.
N#1.498

THERMAL DATA.
ALPHA-BETA TRANSITION 767 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.1800	111	10	1.2370	420
50	2.7610	200	35	1.1300	422
50	1.9540	220	10	1.0650	511
50	1.6680	311	15	0.9787	440
10	1.6130	222	15	0.9364	531
20	1.3850	400	10	0.8756	620
20	1.2700	331	10	0.8445	533

SODIUM HYDROGEN FLUORIDE NAF.HF

REFERENCES.
ASTM 6-0479

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. R-3M
A#3.468 C#13.76 Z# 3 DENSITY#2.16

OPTICAL PROPERTIES.
NO#1.261 NE#1.328 UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
48	4.5930	003	7	1.3187	205
11	2.9350	101	3	1.2515	10.10
100	2.7530	012	3	1.1936	027
3	2.2940	006	2	1.1467	012
49	2.0290	015	3	1.1198	122
31	1.7345	110	3	1.0495	125
22	1.6453	107	1	1.0146	02.10
8	1.6218	113	2	1.0011	030
2	1.5290	009	2	0.9833	217
8	1.4673	202	-1	0.9567	11.12

SODIUM IRON (II) FLUORIDE NAF.FEF2

REFERENCES.
ASTM 10-154,ORNL-2548 P 26.

OPTICAL PROPERTIES.
N(AVERAGE)#1.446,BIAXIAL,2V LARGE,LIGHT BROWN
BIREFRINGENCE LOW,POLYSYNTHETIC TWINNING

THERMAL DATA.
MELTS CONGRUENTLY AT 783 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
25	4.3500	15	2.4620
90	3.9200	45	2.1740
15	3.0800	100	1.9640
30	2.8300	35	1.7830
50	2.7800	20	1.7570
10	2.7310	10	1.7390

SODIUM IRON (II) ZIRCONIUM FLUORIDE NAF.FEF2.2ZRF4

REFERENCES.
ORNL 2274 P101

OPTICAL PROPERTIES.
NX#1.452 NZ#1.459 BIAXIAL NEGATIVE,2V#75
POLYSYNTHETIC TWINNING

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
40	5.2000	20	2.0340
10	4.5000	40	1.9430
100	4.0600	5	1.8120
5	3.7900	15	1.7570
5	3.6900	20	1.7330
100	3.3600	30	1.6820
5	2.6070	20	1.5130
20	2.5210		0.

SODIUM LANTHANUM FLUORIDE NAF.LAF3

REFERENCES.
ASTM 10-153
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
E.P.DERGUNOV, DOKLADY AKAD.NAUK.S.S.S.R.,60,1185,(1948)
F.MATTHES AND S.HOLZ, Z.CHEM.,2,22,(1962)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#6.157 C#3.822 Z#3/2 DENSITY#4.722

OPTICAL PROPERTIES.
NO#1.486 NE#1.500 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO LAF3 AND LIQUID AT 757 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
80	5.3300	100	80	1.7800	121,300
95	3.0800	110	10	1.6240	112
100	3.0110	101	5	1.5530	022
10	2.6700	200	10	1.5390	220
10	2.3980	111	5	1.4790	130
100	2.1860	201	10	1.3870	122
5	2.0150	120	10	1.3790	131

SODIUM LITHIUM BERYLLIUM FLUORIDE 2NAF.LIF.2BEF2

REFERENCES.
ASTM 11-181, ORNL-2548,P42

OPTICAL PROPERTIES.
NO#1.311 UNIAXIAL NEGATIVE,LOW BIREFRINGENCE

THERMAL DATA.
MELTS CONGRUENTLY AT 355 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
25	5.3700	10	2.1110
15	4.0700	5	2.0390
10	3.7800	5	1.9990
20	3.5700	100	1.9680
20	3.3900	10	1.9280
10	3.0800	10	1.8940
55	2.9900	30	1.8400
100	2.7800	20	1.7900
10	2.6140	5	1.7670
15	2.4170	5	1.7480
55	2.3430	20	1.7200
25	2.3030	25	1.7040
5	2.2770	5	1.6780
70	2.2400	10	1.6120
25	2.1490	5	1.5890

SODIUM LITHIUM THORIUM FLUORIDE NAF.2LIF.2THF4

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P3C1 OR P-3C1
A#9.87 C#13.22 Z# 6 DENSITY#6.342

OPTICAL PROPERTIES.
NO#1.520 NE#1.525 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 670 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
15	8.4200	010	15	2.1560	034
20	6.5600	002	50	2.1370	040
40	5.1900	012	50	2.0490	125
30	4.9000	110	55	2.0360	042
60	4.6000	111	10	2.0140	116
5	3.9400	112	5	1.9770	224
40	3.5800	022	5	1.9610	230
100	3.2800	004,113	20	1.9390	321
70	3.1300	121	15	1.8770	322
10	3.0800	014	5	1.8210	126
10	2.8900	122	45	1.7940	412
15	2.8400	030	15	1.7680	315
10	2.7400	114	10	1.7460	036
20	2.6000	123	10	1.6340	331
5	2.4620	220	10	1.5750	235
10	2.2270	132	5	1.5370	150
5	2.2060	006	10	1.5230	151

BETA SODIUM LUTETIUM (III) FLUORIDE NAF.LUF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#5.912 C#3.458 Z#3/2 DENSITY#6.519

OPTICAL PROPERTIES.
NO#1.428 NE#1.422 UNIAXIAL NEGATIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 645 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.0700	100	40	1.7040	300
95	2.9400	110	75	1.6870	211
100	2.8560	101	25	1.6330	012
20	2.5480	200	20	1.4910	112
20	2.2420	111	20	1.4770	220
80	2.0530	201	10	1.4320	202
20	1.9300	210	10	1.4180	310
20	1.7270	002		0.	

ALPHA SODIUM LUTETIUM (III) FLUORIDE 5NAF.9LUF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.463

OPTICAL PROPERTIES.
N#1.484

THERMAL DATA.
ALPHA-BETA TRANSITION 795 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	8.6780	620	10	1.2210	420
100	3.1500	111	35	1.1150	422
50	2.6460	200	10	1.0510	511
50	1.9300	222	15	0.9658	440
50	1.6450	311	15	0.9235	531
20	1.2520	331		0.	

ALPHA SODIUM NEODYMIUM (III) FLUORIDE NAF.NDF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.654 Z# 2 DENSITY#5.447

OPTICAL PROPERTIES.
N#1.511

THERMAL DATA.
ALPHA-BETA TRANSITION 834 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2500	111	20	1.2640	420
50	2.8200	200	10	1.1430	422
50	1.9960	220	35	1.0880	511
50	1.7040	311	10	0.9997	440
10	1.6310	222	15	0.9557	531
20	1.4140	400	10	0.9024	620
20	1.2960	331		0.	

BETA SODIUM NEODYMIUM (III) FLUORIDE NAF.NDF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#6.100 C#3.711 Z#3/2 DENSITY#5.066

OPTICAL PROPERTIES.
NO#1.493 NE#1.515 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 834 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
85	5.2800	100	10	1.3620	311
100	3.0500	110,011	5	1.3590	212
20	2.6390	200	5	1.2780	302
10	2.3540	111	5	1.2050	103
50	2.1510	201	5	1.1790	222
5	1.9930	210	5	1.1210	203
50	1.7600	030,121	5	1.0760	402
10	1.5850	112	5	1.0520	213
5	1.5250	220	5	0.8920	332
5	1.4640	310	5	0.8654	323

ALPHA SODIUM NEODYMIUM (III) FLUORIDE 5NAF.9NDF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.675

OPTICAL PROPERTIES.
N#1.518

THERMAL DATA.
METASTABLE BELOW 814 C WITH RESPECT TO BETA-NAF.NDF3 AND NDF3.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2500	111	20	1.2990	331
50	2.8200	200	20	1.2670	420
50	2.0000	220	10	1.1570	422
50	1.7050	311	35	1.0910	511
10	1.6330	222	10	1.0030	440
20	1.4160	400	15	0.9593	531

SODIUM NICKEL (II) FLUORIDE NAF.NIF2

REFERENCES.
ASTM 10-158,ORNL-2548 P 27

THERMAL DATA.
MELTS CONGRUENTLY AT 1045 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	4.2500	15	2.1300
100	3.8500	10	2.0700
10	3.4500	25	2.0340
5	3.3300	100	1.9240
5	3.0500	5	1.7960
10	3.0100	20	1.7570
35	2.7640	35	1.7420
50	2.7230	30	1.7200
20	2.6820	10	1.6970
10	2.3980	20	1.5860
10	2.3270	20	1.5790
25	2.3090	40	1.5570

SODIUM NICKEL (II) ZIRCONIUM FLUORIDE NAF.NIF2.2ZRF4

REFERENCES.
ORNL 2274 P101

OPTICAL PROPERTIES.
NX#1.460 NY# NZ#1.466 BIAXIAL POSITIVE,2V#30

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.4200	10	2.5000
35	5.1500	25	2.0220
25	4.4800	15	1.9320
100	4.0500	15	1.6700
100	3.3400		0.

SODIUM PLUTONIUM (III) FLUORIDE NAF.PUF3

REFERENCES.
ASTM 6-0355
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)

CRYSTAL SYSTEM. HEXAGONAL
A#6.117 C#3.746 Z#3/2 DENSITY#6.13

OPTICAL PROPERTIES.
NO#1.523 NE#1.552 UNIAXIAL POSITIVE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.0600	110,101	40	1.3740	311,212
60	2.1650	201	20	1.3300	400
40	2.0060	210	40	1.2880	302
40	1.8790	002	20	1.2180	320,103
60	1.7740	300,211,102	10	1.1920	222
40	1.6030	301,112	40	1.1600	410,321,312
40	1.5380	202,220	10	1.1310	203
5	1.4760	310		0.	

BETA SODIUM PRASEODYMIUM (III) FLUORIDE NAF.PRF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#6.123 C#3.743 Z#3/2 DENSITY#4.917

OPTICAL PROPERTIES.
NO#1.494 NE#1.516 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 805 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
45	5.2800	100	10	1.3680	131,122
100	3.0600	110,011	5	1.2850	302
10	2.6440	200	5	1.2140	103
10	2.3670	111	5	1.1820	222
50	2.1600	201	15	1.1560	140,231,132
5	2.0010	210	5	1.1290	203
5	1.8690	002	5	1.0200	330,501,322
60	1.7670	030,121,012	5	0.9224	511,052
10	1.5970	031,112	5	0.8712	323
5	1.5290	220,022		0.	

ALPHA SODIUM SAMARIUM (III) FLUORIDE NAF.SMF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.592 Z# 2 DENSITY#5.474

OPTICAL PROPERTIES.
N#1.493

THERMAL DATA.
ALPHA-BETA TRANSITION 819 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2200	111	50	1.9790	220
50	2.7860	200	50	1.6880	311

BETA SODIUM SAMARIUM (III) FLUORIDE NAF.SMF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/M
A#6.051 C#3.640 Z#3/2 DENSITY#5.380

OPTICAL PROPERTIES.
NO#1.492 NE#1.516 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 819 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
90	5.2400	100	5	1.9810	210
100	3.0300	110	40	1.7400	030,121
90	2.9890	101	5	1.5590	112
15	2.6200	200	5	1.5120	220
5	2.3270	111	5	1.3500	131
40	2.1270	201		0.	

ALPHA SODIUM SAMARIUM (III) FLUORIDE 5NAF.9SMF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.627

OPTICAL PROPERTIES.
N#1.510

THERMAL DATA.
METASTABLE BELOW 765 C WITH RESPECT TO BETA-NAF.SMF3 AND SMF3.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2900	111	10	1.6220	222
50	2.8000	200	20	1.2900	331
50	1.9880	220	10	1.2580	420
50	1.6940	311	35	1.1490	422

BETA SODIUM TERBIUM (III) FLUORIDE NAF.TBF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#6.008 C#3.580 Z#3/2 DENSITY#5.740

OPTICAL PROPERTIES.
NO#1.486 NE#1.506

THERMAL DATA.
ALPHA-BETA TRANSITION 789 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.1900	100	5	1.9680	120
50	2.9950	110	5	1.7910	002
75	2.9430	101	20	1.7350	030
5	2.6030	200	40	1.7240	121
5	2.3020	111	5	1.6930	012
70	2.1060	021	10	1.5380	112

ALPHA SODIUM TERBIUM (III) FLUORIDE 5NAF.9TBF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.575

OPTICAL PROPERTIES.
N#1.502

THERMAL DATA.
METASTABLE BELOW 742 C WITH RESPECT TO BETA-NAF.TBF3 AND TBF3.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2000	111	20	1.2790	331
50	2.7800	200	10	1.2460	420
50	1.9680	220	35	1.1380	422
50	1.6810	311	10	1.0730	511
10	1.6090	222	15	0.9430	531
20	1.3940	400		0.	

SODIUM THORIUM FLUORIDE 4NAF.THF4

REFERENCES.
ASTM 12-568
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
R.E.THOMA ET AL, J.PHYS.CHEM.,63,1266,(1959)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. CUBIC
A#11.04 Z# 8 DENSITY#4.70

OPTICAL PROPERTIES.
N#1.400

THERMAL DATA.
MELTS INCONGRUENTLY TO NAF AND LIQUID AT 627 C.
METASTABLE WITH RESPECT TO NAF AND 7NAF.2THF4.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
15	7.9700	110	15	2.4110	421
30	6.4200	111	15	2.3550	332
30	5.5200	200	25	2.1280	333
100	4.9500	210	45	2.0500	520
45	4.5200	211	5	2.0100	521
25	3.5000	310	10	1.9570	440
20	3.1900	222	25	1.7910	611
75	3.0700	320	10	1.7250	621
70	2.9600	321	5	1.6450	630
20	2.7630	400		0.	

SODIUM THORIUM FLUORIDE 7NAF.2THF4

REFERENCES.
ASTM 12-567
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. HEXAGONAL
A#12.713 C#10.377

OPTICAL PROPERTIES.
NX#1.397 NZ#1.402 BIAXIAL NEGATIVE,2V#85
MICROCLINE TWINNING COMMON

THERMAL DATA.
SUBSOLIDUS COMPOUND,STABLE FROM 558 C TO 610 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
45	6.3660	110	5	1.8350	600
100	5.1930	002	5	1.7640	414
50	4.0210	112	40	1.7310	006
5	3.6710	300	40	1.7310	602
5	3.2970	103	10	1.5670	306
5	3.1720	220	10	1.5670	523
100	2.9980	302	5	1.5210	226
15	2.7110	222	5	1.5210	442
20	2.5940	004	10	1.5000	604
15	2.1810	412	-5	1.4590	524
40	2.1190	304	-5	1.4410	117
10	2.0120	224	-5	1.4050	416
10	1.9630	332	5	1.3420	525

COMMENTS.
INDEXED BY J.H.BURNS

BETA2 SODIUM THORIUM FLUORIDE 2NAF.THF4

REFERENCES.
ASTM 12-564
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
R.E.THOMA ET AL, J.PHYS.CHEM.,63,1266,(1959)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. C32
A#5.99 C#3.81 Z# 1 DENSITY#5.46

OPTICAL PROPERTIES.
NO#1.464 NE#1.496 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 705 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	6.2200	5	2.4420
45	5.7200	10	2.3740
10	5.3800	20	2.3520
100	5.1700	40	2.1970
10	4.5300	5	2.0560
20	4.1100	5	1.9870
5	3.8300	15	1.9550
5	3.6900	15	1.9280
5	3.6500	10	1.9090
10	3.4000	10	1.7930
15	3.3100	55	1.7420
35	3.0700	20	1.7240
70	2.9900	5	1.7050
20	2.8630	5	1.6090
55	2.5900	5	1.5720

DELTA SODIUM THORIUM FLUORIDE 2NAF.THF4

REFERENCES.
ASTM 12-552
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
R.E.THOMA ET AL, J.PHYS.CHEM.,63,1266,(1959)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. HEXAGONAL
A#6.14 C#7.36 Z# 2 DENSITY#5.37

THERMAL DATA.
METASTABLE WITH RESPECT TO BETA-2 2NAF.THF4.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	7.3500	001	15	2.2260	013
45	5.3200	010	55	2.1580	022
65	4.3100	011	5	2.0140	120
100	3.0700	110	10	1.9420	121
10	3.0300	012	20	1.9200	113
10	2.8390	111	25	1.8420	004
10	2.6630	020	20	1.7770	300
30	2.5080	021	30	1.7680	122
10	2.4550	003	20	1.7420	014
15	2.3550	112	15	1.5830	114

SODIUM THORIUM FLUORIDE 3NAF.2THF4

REFERENCES.
ASTM 12-566
R.E.THOMA ET AL, J.PHYS.CHEM.,63,1266,(1959)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. CUBIC
A#5.62

OPTICAL PROPERTIES.
N#1.475

THERMAL DATA.
STABLE FROM 683 C TO 712 C.
MELTS CONGRUENTLY AT 712 C.
DECOMPOSES TO 2NAF.THF4 AND ALPHA NAF.THF4 AT 683 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2500	111	35	1.7040	311
25	2.8220	200	10	1.4130	400
55	1.9970	220		0.	

SODIUM THORIUM FLUORIDE 7NAF.6THF4

REFERENCES.
ASTM 12-563
R.E.THOMA ET AL, J.PHYS.CHEM.,63,1266,(1959)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P3 OR P-3
A#14.96 C#9.912 Z# 3 DENSITY#5.55

OPTICAL PROPERTIES.
NO#1.475 NE1.468 UNIAXIAL NEGATIVE

THERMAL DATA.
METASTABLE WITH RESPECT TO 2NAF.THF4 AND NAF.THF4.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
25	7.8700	101	10	2.6220	303
10	5.4000	201	5	2.4820	004
25	4.6200	102	30	2.2110	124
100	4.3900	121	10	2.1960	242
25	4.3200	300	10	2.1460	143
20	3.7400	220	35	2.0760	250
15	3.4800	122	20	2.0400	134
60	3.3800	131	10	1.9570	432
55	3.3000	003	15	1.7560	523
65	3.2600	302	10	1.7040	154
15	3.0700	401	5	1.6370	541
30	2.9100	132	10	1.5420	306
30	2.8260	140		0.	

COMMENTS.
THE 7-6 RUBIDIUM,POTASSIUM AND SODIUM COMPOUNDS WITH
URANIUM AND THORIUM ARE ISOMORPHOUS

ALPHA SODIUM THORIUM FLUORIDE NAF.THF4

REFERENCES.
ASTM 12-553
R.E.THOMA ET AL, J.PHYS.CHEM.,63,1266,(1959)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P3C1 OR P-3C1
A#10.15 C#13.19 Z# 12 DENSITY#5.928

OPTICAL PROPERTIES.
NX#1.506 NZ#1.540 BIAXIAL NEGATIVE,2V#40

THERMAL DATA.
MELTS INCONGRUENTLY TO NAF.2THF4 AND LIQUID AT 730 C.
ALPHA-BETA TRANSITION BETWEEN 450-550 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
15	8.6700	010	30	2.2920	132
25	6.5600	002	10	2.1970	006
60	5.2600	012	30	2.0800	042
25	5.0700	110	55	2.0710	125
60	4.7200	111	20	2.0190	320,116
15	4.0000	112	30	1.9930	231
50	3.6600	022	15	1.9630	026
100	3.3200	113	10	1.9260	232
85	3.2200	121	40	1.8310	126
20	2.9700	122	10	1.7910	135
15	2.9300	030	15	1.7590	306
15	2.6440	123	15	1.6640	240
90	2.3380	124	10	1.6050	235

BETA SODIUM THORIUM FLUORIDE NAF.THF4

REFERENCES.
ASTM 12-565
R.E.THOMA ET AL, J.PHYS.CHEM.,63,1266,(1959)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

OPTICAL PROPERTIES.
N(AVERAGE)#1.503,BIAXIAL NEGATIVE,2V#SMALL.

THERMAL DATA.
ALPHA-BETA TRANSITION BETWEEN 450-550 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	6.1100	80	2.8850
70	5.0500	30	2.3150
65	4.2300	20	2.2590
20	3.7800	20	2.2060
100	3.3400	35	2.1130
65	3.2400	40	1.9930

SODIUM THORIUM FLUORIDE NAF.2THF4

REFERENCES.
ASTM 12-551
ASTM 4-0465
W.H.ZACHARIASEN,ACTA CRYST. 2,390 (1949)
R.E.THOMA ET AL, J.PHYS.CHEM.,63,1266,(1959)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. CUBIC SPACE GROUP. I-43M
A#8.722 Z# 4 DENSITY#6.58

OPTICAL PROPERTIES.
N#1.550

THERMAL DATA.
MELTS INCONGRUENTLY TO THF4 AND LIQUID AT 831 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	6.1900	110	30	1.8600	332
50	4.3700	200	10	1.7800	224
100	3.5500	112	15	1.7100	134,150
25	3.0700	220	5	1.6000	125
15	2.7700	130	10	1.5000	350
10	2.5200	222	10	1.4600	442,600
10	2.3400	123	10	1.4200	116,235
80	2.0600	330		0.	

BETA SODIUM THULIUM (III) FLUORIDE NAF.TMF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/M
A#5.953 C#3.494 Z#3/2 DENSITY#6.223

OPTICAL PROPERTIES.
NO#1.476 NE#1.496 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 644 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.1800	100	20	1.5090	112
100	2.9800	110	10	1.4890	220
90	2.9020	101	5	1.4300	310
20	2.5790	200	15	1.3240	311
15	2.2700	111	10	1.3020	212
85	2.0790	201	10	1.2260	302
15	1.9490	210	5	1.2100	401
5	1.7500	002	5	1.0000	213
50	1.7190	300	10	0.9457	412
55	1.7030	211	10	0.9026	313
10	1.6560	102		0.	

ALPHA SODIUM THULIUM (III) FLUORIDE 5NAF.9TMF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.493

OPTICAL PROPERTIES.
N#1.490

THERMAL DATA.
ALPHA-BETA TRANSITION 711 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.1500	111	10	1.2270	420
50	2.7300	200	35	1.1100	422
50	1.9420	220	10	1.0570	511
50	1.6540	311	15	0.9284	531
10	1.5830	222	10	0.9154	600
20	1.3720	400	10	0.8691	620

SODIUM URANIUM (III) FLUORIDE NAF.UF3

REFERENCES.
ASTM 10-160
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)

CRYSTAL SYSTEM. HEXAGONAL
A#6.167 C#3.77 Z#3/2 DENSITY#5.92

OPTICAL PROPERTIES.
NO#1.552 NE#1.564 UNIAXIAL POSITIVE,DARK BLUE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
30	5.3500	100	10	1.8980	002
100	3.0900	110	75	1.7790	121
15	2.3920	111	10	1.6140	301
55	2.1790	201	10	1.5410	220
50	2.0160	210		0.	

SODIUM URANIUM (IV) FLUORIDE 7NAF.2UF4

REFERENCES.
C.J.BARTON ET AL, J.AM.CERAM.SOC.,41,63,(1958)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. FMMM,FMMM2 OR F222
A#17.7 B#29.8 C#12.7

OPTICAL PROPERTIES.
NX#1.414 NZ#1.420 BIAXIAL NEGATIVE,2V#60,GREEN

THERMAL DATA.
SUBSOLIDUS COMPOUND. UNSTABLE WITH RESPECT TO NAF AND 3NAF.UF4 ABOVE 546 C AND BELOW 497 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	7.5600	20	2.5700
30	6.2800	15	2.1590
30	5.6800	50	2.0970
30	5.2400	5	2.0650
100	5.1400	5	2.0130
15	4.8100	10	1.9880
10	4.3100	10	1.9470
20	4.0700	10	1.8160
30	3.9800	5	1.7630
15	3.7900	70	1.7140
100	2.9700	5	1.6430
10	2.8000	10	1.5500
10	2.6800	15	1.4870

SODIUM URANIUM (IV) FLUORIDE 3NAF.UF4

REFERENCES.
ASTM 10-157
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
C.J.BARTON ET AL, J.AM.CERAM.SOC.,41,63,(1958)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I4MMM
A#5.448 C#10.896

OPTICAL PROPERTIES.
NO#1.417 NE#1.411 UNIAXIAL NEGATIVE,GREENISH BLUE

THERMAL DATA.
MELTS CONGRUENTLY AT 629 C. METASTABLE WITH RESPECT TO NAF AND 2NAF.UF4 BELOW 528 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
35	5.4700	100	45	1.9260	220,204
100	4.8700	101	25	1.8150	222
50	3.8500	110	30	1.7910	301
75	3.1500	112	35	1.7220	010
30	3.0300	103	30	1.6420	116
30	2.7210	200	15	1.5740	224
30	2.4350	202	15	1.5110	206
25	2.3780	211	15	1.4960	321,107
30	2.2240	114	15	1.4570	314
15	2.0220	105,213		0.	

DELTA SODIUM URANIUM (IV) FLUORIDE 2NAF.UF4

REFERENCES.
ASTM 10-163
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
C.J.BARTON ET AL, J.AM.CERAM.SOC.,41,63,(1958)
R.E.THOMA ET AL, J.PHYS.CHEM.,63,1266,(1959)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. HEXAGONAL
A#6.11 C#7.25 Z# 2 DENSITY#5.68

OPTICAL PROPERTIES.
NO#1.495 NE1.490 UNIAXIAL NEGATIVE,GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO 5NAF.3UF4 AND LIQUID AT 648 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	7.2500	001	20	1.8090	004
20	5.3100	100	5	1.7830	203
75	4.2800	101	15	1.7600	300
35	3.0600	110	25	1.7480	212
60	2.9900	102	15	1.7120	104
10	2.8170	111	10	1.5550	114
5	2.6440	200	5	1.5380	213
15	2.4880	201	5	1.5270	220
20	2.4100	003	5	1.4910	221,204
5	2.3380	112	5	1.4360	311
10	2.1940	103	5	1.4220	303
35	2.1350	202	15	1.3940	105
5	1.9990	210	5	1.3580	312
15	1.9280	211	5	1.3400	214
15	1.8900	113		0.	

COMMENTS.
PROBABLY ISOMORPHOUS WITH DELTA-2NAF.THF4.

GAMMA SODIUM URANIUM (IV) FLUORIDE 2NAF.UF4

REFERENCES.
ASTM 10-162
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
C.J.BARTON ET AL, J.AM.CERAM.SOC.,41,63,(1958)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. IMMM
A#5.56 B#4.01 C#11.64

THERMAL DATA.
METASTABLE WITH RESPECT TO DELTA-2NAF.UF4.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	5.7900	002	50	2.1730	114
100	4.9200	101	50	2.1510	
40	3.7800	011	50	2.0030	003
50	3.2400	110	100	1.9670	213
70	3.1700	103	20	1.9470	
20	2.9100	004	20	1.8960	022
40	2.8310	112	30	1.8600	121
30	2.7670	200	20	1.8260	105,301
20	2.5010	202	10	1.6960	123
50	2.2350	211	80	1.6690	303,115

BETA-2 SODIUM URANIUM (IV) FLUORIDE 2NAF.UF4

REFERENCES.
ASTM 10-159
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
C.J.BARTON ET AL, J.AM.CERAM.SOC.,41,63,(1958)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. HEXAGONAL
A#5.95 C#3.73

OPTICAL PROPERTIES.
NO#1.484 NE#1.522 UNIAXIAL POSITIVE
X#GREENISH TAN,Z#GRAY TAN

THERMAL DATA.
METASTABLE WITH RESPECT TO DELTA-2NAF.UF4.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.1200	100	35	1.9470	120
10	3.7200	001	15	1.8690	002
85	3.0200	101	15	1.7540	102
40	2.9700	110	100	1.7300	211
35	2.5780	200	15	1.5830	112
55	2.3270	111	25	1.5620	301
90	2.1210	201		0.	

SODIUM URANIUM (IV) FLUORIDE 5NAF.3UF4

REFERENCES.
ASTM 10-161
C.J.BARTON ET AL, J.AM.CERAM.SOC.,41,63,(1958)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. CUBIC
A#5.584

OPTICAL PROPERTIES.
N#1.475 GREEN

THERMAL DATA.
MELTS INCONGRUENTLY TO 7NAF.6UF4 AND LIQUID AT 673 C.
METASTABLE WITH RESPECT TO 2NAF.UF4 AND 7NAF.6UF4 BELOW 630 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.1900	111	5	1.3960	400
30	2.7770	200	5	1.2820	331
65	1.9640	220	5	1.2480	420
65	1.6840	311	5	1.1440	422
5	1.6090	222		0.	

SODIUM URANIUM (IV) FLUORIDE 7NAF.6UF4

REFERENCES.
ASTM 10-172
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
C.J.BARTON ET AL, J.AM.CERAM.SOC.,41,63,(1958)
L.A. HARRIS, ORNL CF 58-3-15,(1958)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P3 OR P-3
A#14.72 C#9.84 Z# 3 DENSITY#5.87

OPTICAL PROPERTIES.
NO#1.517 NE#1.509 UNIAXIAL NEGATIVE,GREEN

THERMAL DATA.
MELTS CONGRUENTLY AT 718 C

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
40	7.7600	101	50	2.7860	410
20	5.3400	021	30	2.5850	303
50	4.5500	012	10	2.4370	223
70	4.3200	211	10	2.3420	421
55	4.2500	300	35	2.1770	214
10	3.8700	202	25	2.1140	413
25	3.6800	220	10	2.0730	152
10	3.4300	122	10	2.0470	520
85	3.3300	131	30	2.0410	224
100	3.2500	003	40	1.7420	621
20	3.0300	401	40	1.7310	523
20	2.9700	297	10	1.6440	202,045
50	2.8630	312		0.	

COMMENTS.
THE 7-6 RUBIDIUM,POTASSIUM AND SODIUM COMPOUNDS WITH
URANIUM AND THORIUM ARE ISOMORPHOUS

SODIUM URANIUM (IV) FLUORIDE NAF.2UF4

REFERENCES.
ASTM 10-171
C.J.BARTON ET AL, J.AM.CERAM.SOC.,41,63,(1958)
R.E.THOMA ET AL, J.AM.CERAM.SOC.,46,37,(1963)

OPTICAL PROPERTIES.
NX#1.516 NZ#1.584 BIAXIAL NEGATIVE,2V#30
YELLOWISH GREEN

THERMAL DATA.
SUBSOLIDUS COMPOUND. UNSTABLE ABOVE 660 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	7.8000	10	2.4490
10	6.6100	10	2.4110
20	6.1900	10	2.3550
20	6.0300	10	2.2900
100	5.6100	10	2.2500
25	5.4700	10	2.2110
10	5.2100	10	2.1840
10	4.9800	10	2.1520
10	4.9200	10	2.1440
10	4.8000	10	2.1370
25	4.6500	25	2.1280
35	4.3300	10	2.0900
10	4.0900	30	2.0650
15	4.0400	15	2.0340
15	3.9100	10	2.0100
10	3.8000	15	1.9830
50	3.6900	15	1.9470
15	3.6000	20	1.9390
15	3.5100	30	1.9310
20	3.4300	35	1.9120
20	3.4200	10	1.8650
20	3.4100	10	1.8400
45	3.3000	25	1.8170
70	3.2600	10	1.7920
20	3.1500	10	1.7900
10	3.1200	10	1.7540
65	3.0800	10	1.7420
10	2.9800	20	1.7300
10	2.9000	15	1.7200
10	2.8700	15	1.6430
45	2.8130	10	1.6380
10	2.7470	15	1.5860
10	2.7310	10	1.5840
10	2.6750	15	1.5760
10	2.6220	15	1.5720
10	2.6000	20	1.5540

BETA SODIUM YTTERBIUM (III) FLUORIDE NAF.YBF3

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P-6
A#5.929 C#3.471 Z#3/2 DENSITY#6.412

OPTICAL PROPERTIES.
N(AVERAGE)#1.490 CRYPTOCRYSTALLINE

THERMAL DATA.
STABLE BELOW 595 C. INVERTS TO CUBIC NAF.YBF3 ABOVE 595 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
75	5.1300	100	10	1.9400	210
85	2.9600	110	10	1.7350	002
100	2.8700	101	25	1.7120	300
15	2.5640	200	50	1.6950	211
15	2.2520	111	10	1.4980	112
70	2.0630	201	15	1.4830	220

ALPHA SODIUM YTTERBIUM (III) FLUORIDE 5NAF.9YBF3

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.471

OPTICAL PROPERTIES.
N#1.490

THERMAL DATA.
ALPHA-BETA TRANSITION 778 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.1300	111	20	1.2530	331
50	2.7170	200	10	1.2210	420
50	1.9280	220	35	1.1170	422
50	1.6430	311	10	1.0520	511
10	1.5500	222	10	0.9118	600
20	1.3640	400	10	0.8649	620

ALPHA SODIUM YTTRIUM FLUORIDE NAF.YF3

REFERENCES.
R.E.THOMA ET AL, INORG.CHEM.,2,1005,(1963)

CRYSTAL SYSTEM. CUBIC
A#5.447

OPTICAL PROPERTIES.
N#1.430

THERMAL DATA.
ALPHA-BETA TRANSITION 691 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.1500	111	60	1.3600	400
40	2.7200	200	65	1.2500	331
100	1.9300	220	40	1.2200	420
80	1.6450	113	70	1.1110	224
20	1.5700	222	60	1.0500	333

BETA SODIUM YTTRIUM FLUORIDE NAF.YF3

REFERENCES.
R.E.THOMA ET AL, INORG.CHEM.,2,1005,(1963)
J.H.BURNS, ORNL-3262,16,(1962)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/M
A#5.95 C#3.52 Z#3/2 DENSITY#4.34

OPTICAL PROPERTIES.
NO#1.464 NE#1.486 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 691 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
95	5.1700	100	10	1.5180	112
95	2.9760	110	15	1.4890	220
70	2.9100	101	5	1.4560	022
15	2.5760	200	5	1.4320	310
30	2.2740	111	10	1.3260	131
100	2.0830	021	5	1.3090	212
15	1.9510	120	15	1.2330	302
10	1.7600	002	20	1.1240	140
30	1.7220	300	5	1.0700	411
65	1.7080	121	10	1.0080	
10	1.6670	102		0.	

ALPHA SODIUM YTTRIUM FLUORIDE 5NAF.9YF3

REFERENCES.
R.E.THOMA ET AL, INORG.CHEM.,2,1005,(1963)

CRYSTAL SYSTEM. CUBIC
A#5.530

OPTICAL PROPERTIES.
N#1.473

THERMAL DATA.
MELTS CONGRUENTLY AT 975 C.
ALPHA-BETA TRANSITION 710 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2000	111	5	1.6710	311
80	2.7740	200	5	1.5990	222
5	1.9590	220	5	1.3840	400

BETA SODIUM YTTRIUM FLUORIDE 5NAF.9YF3

REFERENCES.
R.E.THOMA ET AL, INORG.CHEM.,2,1005,(1963)

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. P4/MMM
A#5.52 C#5.52

OPTICAL PROPERTIES.
NO#1.478 NE#1.465 UNIAXIAL NEGATIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 710 C.
UNSTABLE WITH RESPECT TO BETA-NAF.YF3 AND YF3 BELOW 537 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
40	5.5700	10	1.8420
30	3.9100	10	1.7450
100	3.2000	5	1.6710
80	2.7740	5	1.5990
10	2.5780	10	1.5360
10	2.4720	5	1.4570
5	2.1670	5	1.3840
5	1.9590		0.

SODIUM ZIRCONIUM FLUORIDE 3NAF.ZRF4

REFERENCES.
ASTM 10-169
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)
L.A.HARRIS, ACTA CRYST.,12,172,(1959)

CRYSTAL SYSTEM. TETRAGONAL
A#5.31 C#10.50 Z# 2 DENSITY#3.28

OPTICAL PROPERTIES.
NO#1.386 NE#1.381 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 850 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
35	5.2500	002	20	1.8800	202
75	4.7500	101	35	1.8700	211
70	3.7500	110.102	5	1.7700	114
100	3.0600	112	15	1.6000	220,204
10	2.9300	103	5	1.5900	303
10	2.3200	200	5	1.4600	304
5	1.9700	004		0.	

ALPHA SODIUM ZIRCONIUM FLUORIDE 5NAF.2ZRF4

REFERENCES.
ASTM 10-170(FORMERLY LABELED BETA-1-2NAF.ZRF4)
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)

OPTICAL PROPERTIES.
NO#1.396 NE#1.400 UNIAXIAL POSITIVE

THERMAL DATA.
MELTS INCONGRUENTLY TO 3NAF.ZRF4 AND LIQUID AT 640 C.
ALPHA-BETA TRANSITION 523 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
10	5.4500	10	2.2060
55	5.1500	5	2.1690
25	4.7300	10	2.0880
15	4.0600	15	2.0380
5	3.8300	10	1.9950
40	3.7200	5	1.9510
15	3.4800	100	1.8900
5	3.4300	5	1.8470
5	3.1500	5	1.8120
100	3.0900	10	1.7760
5	2.8390	5	1.7110
10	2.6820	5	1.6880
5	2.5930	5	1.6300
10	2.3270	45	1.6110
5	2.2370		0.

BETA SODIUM ZIRCONIUM FLUORIDE 5NAF.2ZRF4

REFERENCES.
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)

OPTICAL PROPERTIES.
NX#1.393 NZ#1.402 BIAXIAL NEGATIVE,2V#40

THERMAL DATA.
ALPHA-BETA TRANSITION 523 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
25	5.7600	10	2.4160
15	5.0600	15	2.3440
100	4.9700	10	2.3020
20	4.6800	10	2.2060
50	4.4800	10	2.1230
25	4.3700	10	2.0900
75	4.1800	10	2.0290
25	3.6100	20	1.9770
5	3.4500	75	1.8990
5	3.3800	5	1.8630
30	3.2900	25	1.8400
10	3.1900	10	1.8070
100	3.1100	10	1.6660
100	3.0500	15	1.6480
15	2.8660	10	1.5900
15	2.8440	10	1.5780
10	2.4850		0.

ALPHA SODIUM ZIRCONIUM FLUORIDE 2NAF.ZRF4

REFERENCES.
ASTM 10-167(FORMERLY LABELED BETA-2-2NAF.ZRF4)
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)

OPTICAL PROPERTIES.
NX#1.412 NZ#1.419 BIAXIAL NEGATIVE,2V#75

THERMAL DATA.
MELTS INCONGRUENTLY TO ALPHA 5NAF.2ZRF4 AND LIQUID AT 544 C.
ALPHA-BETA TRANSITION 533 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
20	5.7200	20	2.2160
80	5.4700	20	2.0430
50	5.3800	100	1.9120
80	3.7800	80	1.8970
20	3.3100	20	1.7930
100	3.1100	20	1.6450
20	2.6750	50	1.6170
20	2.4100	10	1.5570

BETA SODIUM ZIRCONIUM FLUORIDE 2NAF.ZRF4

REFERENCES.
ASTM 10-168(FORMERLY LABELED BETA-3-2NAF.ZRF4)
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)

CRYSTAL SYSTEM. TETRAGONAL
A#13.85 C#10.23

OPTICAL PROPERTIES.
NO#1.376 NE#1.386 UNIAXIAL POSITIVE

THERMAL DATA.
ALPHA-BETA TRANSITION 533 C.
BETA-GAMMA TRANSITION 505 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.1200	002	10	2.5570	004
10	4.8000	102	10	2.5500	233
100	4.5500	112	40	2.4750	114
5	4.0000	131	30	2.2750	160
10	3.8900	230	30	2.2210	161
90	3.6000	231	10	2.0850	134
25	3.2400	113	100	1.8940	163
10	3.1200	331	30	1.7990	462
10	3.0400	023	60	1.7080	245
40	2.9500	241	5	1.6080	364
100	2.8930	042	20	1.5430	083

GAMMA SODIUM ZIRCONIUM FLUORIDE 2NAF.ZRF4

REFERENCES.
ASTM 10-165(FORMERLY LABELED BETA-4-2NAF.ZRF4)
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)

OPTICAL PROPERTIES.
NX#1.408 NZ#1.412 BIAXIAL POSITIVE,2V#75

THERMAL DATA.
BETA-GAMMA TRANSITION 505 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
35	7.9700	20	2.5640
15	5.5400	15	2.3980
80	5.1200	15	2.3610
65	4.8800	15	2.3270
15	4.4800	20	2.0340
20	4.3300	15	1.9790
70	4.0000	20	1.9350
70	3.8300	50	1.9120
100	3.2500	15	1.7960
50	3.1200	10	1.7510
40	3.0400	20	1.7110
15	2.8900	10	1.6190
25	2.7590	20	1.5960
20	2.6660	15	1.5740

DELTA SODIUM ZIRCONIUM FLUORIDE 2NAF.ZRF4

REFERENCES.
ASTM 10-166(FORMERLY LABELED GAMMA-2NAF.ZRF4)
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)

OPTICAL PROPERTIES.
NX#1.420 NZ#1.429 BIAXIAL NEGATIVE,2V#70
POLYSYNTHETIC TWINNING

THERMAL DATA.
STABLE BELOW 460 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
100	4.9800	60	3.3600
50	4.3700	40	3.1600
80	4.1900	80	3.0700
50	3.9600	70	2.8390
50	3.4500	50	1.8430

SODIUM ZIRCONIUM FLUORIDE 7NAF.6ZRF4

REFERENCES.
ASTM 10-177
W.H.ZACHARIASEN,J.AM.CHEM.SOC.,70,2147,(1948)
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)

CRYSTAL SYSTEM. HEXAGONAL
A#13.80 C#9.40

OPTICAL PROPERTIES.
NO#1.508 NE#1.500 UNIAXIAL NEGATIVE

THERMAL DATA.
MELTS CONGRUENTLY AT 525 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
20	7.3700	101	10	2.0300	422
10	6.8600	110	15	2.0000	600,413
10	5.0700	021	15	1.9500	152
20	4.3700	012	100	1.9200	431,134
25	4.0600	211	100	1.9100	520
5	3.9800	300	15	1.8600	015
10	3.6900	202	10	1.8100	342
40	3.4500	220	10	1.7900	2-25
5	3.2500	122	10	1.7400	414
100	3.1300	003,131	10	1.7000	305
5	2.8500	401	10	1.6800	063
15	2.7200	302	50	1.6300	621
5	2.6400	321	5	1.6100	24-2
5	2.3700	232	5	1.5800	710
5	2.3200	223	10	1.5600	171
5	2.1900	502	15	1.5100	451,434
10	2.0900	511,214	10	1.4800	126

SODIUM ZIRCONIUM FLUORIDE NAF.ZRF4

REFERENCES.
ORNL 2192
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)

OPTICAL PROPERTIES.
NO#1.417 NE#1.446 UNIAXIAL POSITIVE

THERMAL DATA.
METASTABLE WITH RESPECT TO 7NAF.6ZRF4 AND 3NAF.4ZRF4

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
30	5.5700	5	2.0500
30	3.9600	15	2.0200
100	3.8600	5	2.0000
40	3.3700	10	1.9900
15	3.0100	15	1.8600
10	2.8600	5	1.8400
5	2.7500	20	1.7000
5	2.7200	20	1.6500
5	2.5100	10	1.6300
25	2.2800	5	1.6100
20	2.2100	10	1.5600
30	2.0900		0.

SODIUM ZIRCONIUM FLUORIDE 3NAF.4ZRF4

REFERENCES.
ASTM 10-176
C.J.BARTON ET AL,J.PHYS.CHEM.,62,665,(1958)

OPTICAL PROPERTIES.
NX#1.420 NZ#1.432 BIAXIAL POSITIVE,2V#30

THERMAL DATA.
MELTS INCONGRUENTLY TO ZRF4 AND LIQUID AT 537 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
15	7.5600	35	3.3900
45	7.4200	60	3.3600
15	5.4700	15	2.6300
100	4.1500	75	2.0740
20	3.7800	10	1.9350
20	3.7400	50	1.7660
25	3.4200	25	1.5060

TERBIUM (III) FLUORIDE TBF3

REFERENCES.
ASTM 5-0398
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.513 B#6.949 C#4.384 Z# 4 DENSITY#7.236

OPTICAL PROPERTIES.
NX#1.570 NZ#1.600 BIAXIAL NEGATIVE,2V#80

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	3.7100	011	50	1.5100	312
100	3.6300	101	50	1.4900	411,331
100	3.4900	020	50	1.4700	420
100	3.2200	111	20	1.4500	241
50	2.9500	210	100	1.4300	013,232
5	2.6100	201	30	1.4100	322
20	2.5200	121	30	1.4000	113
5	2.4500	211	50	1.3600	042
5	2.3800	220	60	1.3300	203,430
50	2.1900	002	5	1.3200	051
50	2.0900	221	5	1.3200	123
50	1.9900	112	30	1.3100	402
100	1.9500	131	90	1.3000	341
50	1.9400	301	20	1.3000	151
50	1.8800	230	50	1.2800	250
20	1.8700	311	20	1.2800	412
50	1.8500	022	20	1.2400	033
50	1.7800	122	100	1.2400	223
60	1.7600	212	50	1.2300	511
50	1.7300	040	50	1.2200	422
60	1.7000	321	20	1.2000	313
50	1.6200	400	50	1.1900	440
5	1.5800	410	50	1.1700	521
50	1.5700	141	100	1.1600	060
50	1.5500	132	50	1.1500	152

THORIUM FLUORIDE THF4

REFERENCES.
W.H.ZACHARIASEN,ACTA CRYST. 2,390 (1949)
A.J.DARNELL AND F.J.KENESHEA,JR.,J.PHYS.CHEM.,62,1143,(1958)

CRYSTAL SYSTEM. MONOCLINIC
A#13.1 B#11.1 C#8.6 BETA#126.0

OPTICAL PROPERTIES.
NX#1.500 NY#1.518 NZ#1.534 BIAXIAL NEGATIVE
TWINNING COMMON

THERMAL DATA.
MELTING POINT-1111 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	7.6300	110	35	2.1320	13-3
10	5.2400	200	35	2.1130	051
20	4.7500	210	5	2.0670	50-4
10	4.4600	NI	20	2.0400	20-4
80	4.2900	20-2	20	2.0230	103
60	4.0200	31-1	35	1.9850	61-1
100	3.8000	220	15	1.9650	033
5	3.7200	030	15	1.9370	312
50	3.6300	31-2	25	1.9220	22-4
15	3.4300	32-1	10	1.8810	350
50	3.3500	310	5	1.8590	322
5	3.0400	230	10	1.7710	63-1
5	2.8480	102	10	1.7370	332
5	2.7960	23-2	20	1.6830	620
15	2.7470	13-2	10	1.6660	73-3
5	2.7230	21-3	10	1.6400	55-3
5	2.6290	41-3	10	1.6120	252
10	2.5280	311	5	1.5880	531
10	2.4950	231	10	1.5850	64-4
5	2.3610	12-3	20	1.5200	270
10	2.3500	321	5	1.4840	11-5
10	2.3380	34-1	20	1.4550	512
5	2.2590	52-1	10	1.4310	64-5
5	2.2420	23-3	5	1.4040	66-2
5	2.1960	340	10	1.3730	26-4
15	2.1560	430		0.	

THORIUM OXIDE THO2

REFERENCES.
ASTM 4-0556

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.600 Z# 4 DENSITY#9.991

OPTICAL PROPERTIES.
N#2.11

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.2340	111	20	1.1432	422
35	2.8000	200	19	1.0779	511
58	1.9800	220	6	0.9900	440
64	1.6890	311	18	0.9465	531
11	1.6160	222	8	0.9333	600
8	1.4000	400	14	0.8854	620
26	1.2840	331	9	0.8540	533
17	1.2520	420	9	0.8441	622

THULIUM (III) FLUORIDE TMF3

REFERENCES.
ASTM 5-0539
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.283 B#6.811 C#4.408 Z# 4 DENSITY#7.971

OPTICAL PROPERTIES.
NX#1.564 NZ#1.598 BIAXIAL NEGATIVE,2V#90

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	3.6900	011	35	1.4600	331
65	3.6100	101	35	1.4400	013
65	3.4200	020	25	1.4300	241
100	3.1900	111	25	1.4200	113
65	2.8800	210	50	1.4200	232
60	2.4800	121	25	1.4000	322
25	2.4100	211	40	1.3900	042
5	2.3200	220	25	1.3500	203
40	2.2000	002	25	1.3300	142
40	2.0500	221	25	1.3200	123
75	1.9800	112	15	1.3200	051
75	1.9300	131	25	1.3100	402
60	1.9100	301	35	1.2900	151
40	1.8500	230	65	1.2800	341
40	1.8500	022	5	1.2700	332
50	1.8400	311	50	1.2600	250
50	1.7700	122	25	1.2500	431
50	1.7500	212	75	1.2400	223
35	1.7100	040	25	1.2300	033
40	1.6700	321	5	1.2200	501
25	1.5900	400	5	1.2100	251
35	1.5500	141	50	1.2000	422
25	1.5300	132	25	1.2000	511
5	1.5200	302	5	1.1900	313
40	1.4900	312	75	1.1600	440
25	1.4600	420		0.	

URANIUM (III) CHLORIDE UCL3

REFERENCES.
E.STARITZKY, ANAL.CHEM.,28,1055,(1956)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/M
A#7.441 C#4.322 Z# 2 DENSITY#5.520

OPTICAL PROPERTIES.
NO#1.965 NE#2.08 UNIAXIAL POSITIVE
O#OLIVE GREEN,E#BROWNISH GREEN

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
55	6.7000	110	15	2.0500	102
60	6.3900	100	20	1.8610	112
75	3.5700	101	20	1.8580	220
20	3.2100	200	14	1.7870	310,3-40
10	2.8100	111	30	1.6510	311,3-41
95	2.5700	201	15	1.6150	212,2-32
20	2.4300	210,2-30	30	1.5210	302
20	2.1600	002	5	1.5080	401
45	2.1400	300	10	1.4780	320,3-50
100	2.1200	211,2-31	35	1.4060	222

URANIUM (IV) CHLORIDE UCL4

REFERENCES.
E.STARITZKY, ANAL.CHEM.,28,1055,(1956)

CRYSTAL SYSTEM. TETRAGONAL SPACE GROUP. I4/AMD
A#8.298 C#7.486 Z# 4 DENSITY#4.894

OPTICAL PROPERTIES.
NO#2.03 NE#1.92 UNIAXIAL NEGATIVE
O#GREENISH YELLOW,E#GREEN

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	5.5300	101	35	1.8470	420
45	4.1200	200	35	1.8470	303
35	3.3000	211	30	1.7300	332
50	3.1400	112	20	1.7030	204
10	2.9200	220	5	1.6900	323
20	2.7700	202	30	1.6200	501,431
70	2.5800	301	25	1.5760	224
65	2.3850	103	20	1.5620	413
45	2.1910	321	5	1.5230	314
85	2.1370	312	5	1.5040	521
50	2.0640	400	25	1.4890	512
50	2.0640	213	10	1.4670	440
25	1.9390	411	10	1.4670	105
50	1.8620	004		0.	

URANIUM (III) FLUORIDE UF3

REFERENCES.
E.STARITZKY AND R.M.DOUGLASS, ANAL.CHEM.,28,1056,(1956)

CRYSTAL SYSTEM. HEXAGONAL SPACE GROUP. P63/MCM
A#7.179 C#7.345 Z# 6 DENSITY#8.965

OPTICAL PROPERTIES.
NO#1.732 NE#1.738 UNIAXIAL POSITIVE
O#REDDISH VIOLET,E#BROWNISH VIOLET

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
201	8.3400	004	30	1.4470	203
601	8.0300	112	35	1.3740	114
151	7.9500	200	35	1.3590	105
60	3.6700	002	40	1.3340	121
30	3.5800	100	5	1.2820	204
100	3.2100	101	10	1.2720	122
20	2.5600	102	10	1.2240	006
60	2.0690	110	20	1.1960	300
40	1.7410	201	40	1.1870	123
15	1.6330	104	902	0.2200	103
10	1.6110	202		0.	

URANIUM (IV) FLUORIDE UF4

REFERENCES.
ASTM 12-701
A.C.LARSON,R.B.ROOF AND D.T.CROMER, ACTA CRYST.,17,555,(1964)

CRYSTAL SYSTEM. MONOCLINIC SPACE GROUP. C2/C
A#12.73 B#10.75 C#8.43 Z# 12
BETA#126.33 DENSITY#6.72

OPTICAL PROPERTIES.
NX#1.552 NY#1.584 NZ#1.598 BIAXIAL NEGATIVE,2V#66

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
20	7.5200	110	20	2.6660	13-2
20	6.6300	11-1	20	2.5800	400
10	5.4100	020	20	2.4710	24-1
20	5.1700	200	10	2.4540	311
100	4.2130	021	10	2.4410	22-3
60	4.1830	20-2	40	2.1210	60-2
60	3.9570	31-1	20	2.1090	042
80	3.7280	220	40	2.0950	40-4
60	3.5550	31-2	70	2.0790	241
40	3.3740	130	70	2.0680	331
60	3.2990	22-2,13-1	10	2.0360	44-2
50	3.2760	310	20	2.0240	44-1
10	2.7980	221	60	2.0010	20-4
10	2.7820	NI	40	1.9860	51-4
40	2.7050	31-3	40	1.9770	53-3
40	2.6890	112		0.	

URANIUM(IV) OXIDE UO2

REFERENCES.
ASTM 5-0550

CRYSTAL SYSTEM. CUBIC SPACE GROUP. FM3M
A#5.4682 Z# 4 DENSITY#10.968

OPTICAL PROPERTIES.
N#2.36 SALMON PINK IN THINSECTION

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.1570	111	13	1.1163	422
48	2.7350	200	15	1.0523	511
49	1.9340	220	6	0.9666	440
47	1.6490	311	15	0.9243	531
13	1.5790	222	8	0.9114	600
9	1.3680	400	9	0.8646	620
18	1.2550	331	7	0.8339	533
15	1.2230	420	7	0.8243	622

URANYL SILICATE HYDRATE 2UO2.SIO4.3H2O

REFERENCES.
W.L.MARSHALL AND J.S.GILL, J.AM.CHEM.SOC.,79,1300,(1957)

THERMAL DATA.
STABLE TO 400 C.

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
55	6.1080	5	2.1590
20	4.7200	5	2.1360
25	4.5750	5	2.0990
100	4.4500	20	2.0760
20	3.7230	5	2.0560
80	3.2820	10	2.0280
25	3.2090	20	1.9630
5	3.1190	20	1.8950
20	2.9520	5	1.8750
10	2.7670	20	1.8460
50	2.6870	20	1.7580
5	2.6220	5	1.7260
5	2.5680	10	1.6960
5	2.5250	10	1.6690
35	2.4620	10	1.6570
20	2.4380	10	1.6530
5	2.3740	20	1.6380
10	2.3090	20	1.6340
15	2.2380	10	1.5900
10	2.1900	10	1.5740

VANADIUM (III) FLUORIDE VF3

REFERENCES.
B.J. STURM AND C.W. SHERIDAN, INORG.SYNTHESES 7,87 (1963)
ASTM 6-0209

CRYSTAL SYSTEM. RHOMBOHEDRAL SPACE GROUP. R-3C
A#5.373 ALPHA#57.866 Z# 2 DENSITY#3.46

OPTICAL PROPERTIES.
NX#1.536 NZ#1.544 BIAXIAL POSITIVE, 2V#5-10

THERMAL DATA.
MELTS CONGRUENTLY AT 1406 C.

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
100	3.7200	110	31	1.4900	2-1-1
15	2.6800	211	9	1.4310	320
3	2.5800	1-10	22	1.3410	422
58	2.2300	210,222	29	1.2910	2-20,432
47	1.8590	220	14	1.2830	433
71	1.6850	321	7	1.2690	421
26	1.6400	21-1	30	1.2380	31-1,330
5	1.5690	332	56	1.2200	3-10
18	1.5100	310	10	1.1900	431

COMMENTS.
THE LINES WERE INDEXED ON A CELL OF ONLY ONE MOLECULE, BUT THE PROPOSED STRUCTURE REQUIRES A BIMOLECULAR UNIT CELL.(ASTM 6-0209)

YTTERBIUM (III) FLUORIDE YBF3

REFERENCES.
ASTM 5-551
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).
E.STARITZKY, ANAL.CHEM.,29,856,(1957)

CRYSTAL SYSTEM. ORTHORHOMBIC
A#6.216 B#6.786 C#4.434 Z# 4 DENSITY#8.168

OPTICAL PROPERTIES.
NX#1.558 NY#1.568 NZ#1.594 BIAXIAL POSITIVE,2V#85
LOWER INDICES THAN STARITZKY GOT

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
5	3.6900	011	30	1.4700	312
60	3.5900	101	60	1.4400	331,013
50	3.3900	020	5	1.4300	411
100	3.1800	111	100	1.4100	420,241,232
90	2.8200	210	1	1.3800	322
60	2.4700	121	40	1.3400	042,421
20	2.2100	002	40	1.3300	203
40	2.0300	221	20	1.3200	123
50	1.9900	112	20	1.3100	142
100	1.9100	131	5	1.2900	051
50	1.8700	301	1	1.2800	430
40	1.8500	022	20	1.2700	402
60	1.8200	230	60	1.2700	151
40	1.8000	311	100	1.2600	341
30	1.7700	122	50	1.2400	250
60	1.7400	212	100	1.2400	223
40	1.6900	040	1	1.2300	431
50	1.6400	321	1	1.1900	501,251
20	1.5500	400	100	1.1800	422
50	1.5300	132	50	1.1800	511

YTTRIUM FLUORIDE YF3

REFERENCES.
ASTM 5-0546
A.ZALKIN AND D.H.TEMPLETON, J.AM.CHEM.SOC. 75, 2453 (1953).
E.STARITZKY, ANAL.CHEM.,29,856,(1957)

CRYSTAL SYSTEM. ORTHORHOMBIC SPACE GROUP. PNMA
A#6.353 B#6.850 C#4.393 Z# 4 DENSITY#5.069

OPTICAL PROPERTIES.
NX#1.536 NY#1.553 NZ#1.569 BIAXIAL NEGATIVE,2V#85
X#C,Y#B,Z#A,TWINNED ON (101)

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
50	3.6900	011	25	1.4600	420
65	3.6100	101	35	1.4400	013
65	3.4200	020	25	1.4300	241
100	3.1900	111	50	1.4200	232
65	2.8800	210	25	1.4200	113
60	2.4800	121	25	1.4000	322
25	2.4100	211	40	1.3900	042
5	2.3200	220	25	1.3500	203
40	2.2000	002	25	1.3300	142
40	2.0500	221	25	1.3200	123
75	1.9800	112	15	1.3200	051
75	1.9300	131	25	1.3100	402
60	1.9100	301	35	1.2900	151
40	1.8500	022	65	1.2800	341
40	1.8500	230	5	1.2700	332
50	1.8400	311	50	1.2600	250
50	1.7700	122	25	1.2500	431
50	1.7500	212	75	1.2400	223
35	1.7100	040	25	1.2300	033
40	1.6700	321	5	1.2200	501
25	1.5900	400	5	1.2100	251
35	1.5500	141	25	1.2000	511
25	1.5300	132	50	1.2000	422
5	1.5200	302	5	1.1900	313
40	1.4900	312	75	1.1600	440
35	1.4600	331		0.	

ZINC ZIRCONIUM FLUORIDE ZNF2.ZRF4

OPTICAL PROPERTIES.
N#1.434

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
5	4.6800	15	2.2260
35	4.4900	35	2.0080
5	4.1500	20	1.9890
100	4.0600	10	1.8150
15	3.5500	65	1.7960
15	3.1500	50	1.7930
50	2.8520	30	1.6380

ZIRCONIUM CHLORIDE ZRCL4

REFERENCES.
ASTM 5-0839

OPTICAL PROPERTIES.
NX#1.76 NZ#1.83 BIAXIAL,2V LARGE
ANGLE Z-C#22 DEGREES

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
17	7.4800	4	2.8900
53	6.0000	100	2.5900
53	4.6200	4	2.4700
53	4.2300	4	2.3800
4	3.6900	12	2.2700
9	3.2900	4	2.1200
7	3.1300	9	2.0000
5	3.0000		0.

ZIRCONIUM FLUORIDE ZRF4

REFERENCES.
R.D.BURBANK AND F.N.BENSEY, USAEC REPORT K-1280,(1956)

CRYSTAL SYSTEM. MONOCLINIC SPACE GROUP. I2/C
A#9.57 B#9.93 C#7.73 Z# 12
BETA#94.47 DENSITY#4.549

OPTICAL PROPERTIES.
NX#1.560 NY#1.598 NZ#1.606 BIAXIAL NEGATIVE,2V#52

XRAY DATA.

I/I CAL	D-CAL	HKL	I/I CAL	D-CAL	HKL
15	6.8800	110	5	2.1400	213
25	6.0900	011	5	2.0290	033
5	4.9700	020	5	2.0210	-332
20	4.7700	200	25	1.9610	402
100	3.8800	-121,-211	5	1.9430	150,-242
10	3.8500	002	25	1.9360	-422
100	3.6500	211	5	1.9240	332
100	3.4400	-112,220	5	1.9230	051
50	3.2800	112	50	1.9190	-341
30	3.1200	130,-202	55	1.9100	-233
50	3.0300	022,031,310	5	1.9060	-431
5	2.5800	-321	5	1.8830	242
5	2.4900	013,222	20	1.8740	510
5	2.4720	-312	35	1.8490	431
5	2.3850	400	20	1.8370	-204
5	2.3070	-141	5	1.8290	114,233
5	2.1760	411	35	1.7960	024,323

COMMENTS.
SYNTHETIC POWDER PATTERN CALCULATED FROM STRUCTURE

ZIRCONIUM OXIDE FLUORIDE ZROF2

CRYSTAL SYSTEM. ORTHORHOMBIC
A#13.10 B#8.10 C#11.48

OPTICAL PROPERTIES.
NX#1.730 NZ#1.840 BIAXIAL NEGATIVE,2V#LARGE

XRAY DATA.

I/I	D-OBS	HKL	I/I	D-OBS	HKL
10	6.5400	200	15	2.7000	030
5	5.7600	002	15	2.5600	420
5	5.2500	102	5	2.5200	214
5	4.4800	110	5	2.2600	105
70	4.0500	020	15	2.1200	423
5	3.6200	311	5	2.0660	324
100	3.2900	400	10	2.0280	040
35	3.2000	312	80	1.9130	006
5	2.7600	023	25	1.8700	151

ZIRCONIUM URANIUM (III) FLUORIDE 3ZRF4.UF3

REFERENCES.
ASTM 10-175

OPTICAL PROPERTIES.
N(AVERAGE)#1.560,BIAXIAL,2V LARGE,RED

XRAY DATA.

I/I	D-OBS	I/I	D-OBS
35	6.1500	10	2.0100
100	4.1100	10	1.9800
20	3.9500	10	1.9500
10	3.8800	35	1.9200
75	3.7200	30	1.8600
35	3.4400	35	1.8400
20	3.2200	20	1.8100
35	3.1700	20	1.7700
10	2.7700	20	1.7300
30	2.6900	15	1.6800
25	2.5100	5	1.6400
20	2.2900	5	1.6200
15	2.2500	5	1.5900
10	2.1200	5	1.5800
85	2.0600	10	1.5400
10	2.0200		0.

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