IRSN Mephista-19 Nuclear Fuels Database (MEPH19)

Technical Information

Available Starting with Thermo-Calc Version 2021a

Document created 11/16/2020

About the IRSN Mephista-19 Nuclear Fuels Database (MEPH19)

MEPH: IRSN Mephista Nuclear Fuels Database Revision History

MEPH19 is a thermodynamic and properties database, owned by IRSN, which can be applied to successfully study fundamental scientific issues and efficiently investigate practical engineering problems in new generation nuclear fuels. It effectively allows you to calculate the thermochemical equilibrium states in nuclear fuels and to utilize the calculation results for enhancing the design and engineering of modern and safety-prioritized nuclear reactors, improving the predictions and treatments of operational accidents and assisting the assessment and processing of nuclear fuel and waste managements.

The database contains critically-assessed and internally-consistent thermodynamic data for the entire field from metal to oxide domains within a 14-element framework, +H and +Ar, which are only for the gaseous phase and for hydrides and hydrous oxides/silicates.

Elements (14+2)

Ar	Ba	C	Ce	Cs	Fe	H	La	Mo	O
Pu	Ru	Si	Sr	U	Zr				

Phases and Assessed Subsystems

See the *Overview of Mephista-19* pages at the end of this PDF that have details such as atoms, stoichiometric condensed phases, condensed solutions, gas, and the assessed binary, ternary, and quaternary systems.

Available Solution and Stoichiometric Phases

Condensed solution phases: *(solids/liquid phases)*	47 phases
Condensed stoichiometric phases: *(solid/liquid substances)*	242 phases
Gaseous mixture phase: *(ideal gaseous mixture)*	159 gaseous species

The hydrogen element (H) being as a major component is added into the system, while its dissolution in condensed solid and liquid solution phases has not been taken into account yet. The Ar component is only present in the gaseous mixture phase. Included condensed stoichiometric phases (pure substances) are widely ranged: intermediate metallic compounds, oxides and hydroxides, silicates and hydrous silicates, hydrides, carbides and carbonates, and some simple inorganic/organic substances.

Available Assessments and Evaluations

Binary subsystems: *(metallic alloys, carbides, oxides)*	91
Ternary subsystems: *(metallic alloys, carbides, oxides, silicates)*	50
Quaternary subsystems: *(oxides, silicates)*	2

For many other ternary, quaternary and higher-order subsystems, the analytical descriptions of lower-order constituent subsystems are effectively combined and used (through appropriate extrapolations) to predict multicomponent systems, especially for compositions and temperatures which have not been experimentally evaluated. Depending on the complexity of multicomponent systems, such an analytical prediction will be more or less accurate.

Limits

As in the spirit of the CALPHAD method, predictions can be made for multicomponent systems by extrapolation into multicomponent space of data critically evaluated and assessed based on binary, ternary and in some cases higher order systems. However, critical calculations must always be verified by equilibrium experimental data; it is the user's responsibility to verify the calculations but Thermo-Calc Software AB is interested to know about any significant deviations in order to improve any future release.

Additional Resources

This document is available on our website on the Nuclear Materials Databases page, where you can also link to many other resources. Alternatively, when in Thermo-Calc, press F1 to search the online help for more information.

MEPH: IRSN Mephista Nuclear Fuels Database Revision History

Current Database Version

Database name (acronym):	**IRSN Mephista-19 Nuclear Fuels Database (MEPH19)**
Database owner:	**IRSN**
Database version:	**19**

Changes in the Most Recent Database Release

MEPH15 (Mephista-15-1) to MEPH19 (Mephista-19)

IRSN Mephista Nuclear Fuels Database (MEPH19)

Software release version: 2021a (January 2021)

Binary Systems

- Cr-Ru and Fe-Ru: The lattice-stability of Ru(BCC_A2) available in the Unary 5.0 SGTE database taken into account
- Fe-Si: Y. Yuan et al. Calphad, 44:54–61, 2014.
- Fe-U: The lattice-stabilities of Fe(ORT_A20) and Fe(TET) available in the Unary 5.0 SGTE database taken into account
- La-U: Improvement of liquid thermodynamic properties
- La-Zr: N. Mattern et al. Calphad, 52:8–20, 2016.
- Ru-U: The lattice-stability of Ru(BCC_A2) and U(hcp_A3) available in the Unary 5.0 SGTE database taken into account. The Ru3U compound is now modeled as a solution phase, CxRU3U1 (SS).
- Si-Sr: Li et al., Calphad, 35(4):594–600, 2011.
- Si-Zr: Revised to suppress the appearance of a miscibility gap at the liquid state.
- U-Zr: The lattice-stability of U(hcp_A3) available in the Unary 5.0 SGTE database taken into account. Improvement of the modeling of liquid and DELTA_UZr_2 thermodynamic properties

Pseudo-binary Systems

- Ba-O-Si BaO-SiO_2: Additional compound in the BaO-rich part, BA3O5SI1(S).
- La-O-U La_2O_3-UO_2: Improvement of the oxygen potential above the solid solution FCC_C1.
- La-O-Si La_2O_3-SiO_2: Improvement of the thermodynamic properties of $La_2Si_2O_7$

- O-Si-Sr SiO_2-SrO: Improvement with consideration of new experimental data.
- O-Si-Zr SiO_2-ZrO_2: Improvement of the description of the $ZrSiO_4$ compound (thermodynamic properties and decomposition temperature)

Ternary Systems

- C-O-Zr: Improvement with consideration of new experimental data.
- Reassessment of the Fe-O-U, Fe-O-Zr, and O-U-Zr systems

Previous Releases

MEPH11 (Mephista-11) to MEPH15 (Mephista-15)

IRSN Mephista Nuclear Fuels Database (MEPH15_1)

Software release version: 2017a (March 2017)

Binary Systems

The description of some binary systems are improved:

- C-Pu: improved modeling of the liquidus.
- C-U: C3U2(S) made unstable at low temperature.
- O-Pu: melting temperature of O2Pu1(S) increased and the improved modeling of LIQUID.

Ternary Systems

The description of the following ternary systems are re-assessed by taking into account the previous improvements:

- Ce-O-Pu: revised modeling of CeO_2-PuO_2 and Ce_2O_3-PuO_2.
- Fe-O-Pu: revised modeling of FeO-PuO_2 and Fe_2O_3-PuO_2.
- La-O-Pu: revised modeling of La_2O_3-PuO_2.
- Mo-O -Pu: revised modeling of MoO_3-PuO_2.
- O-Pu -Si: revised modeling of SiO_2-PuO_2.
- O-Pu-Sr: revised modeling of SrO-PuO_2.
- O-Pu-Zr: revised modeling of PuO_2-ZrO_2.
- C-O-Pu: revised modeling of the full system.

The description of some ternary systems are improved:

- O-Pu-U: improved modeling of PuO_2-UO_2; improved modeling of the FCC_C1 miscibility gap.
- Ba-O-Pu: improved modeling of BaO-PuO_2.
- Ba-Mo-O: improved modeling of Ba1Mo1O4 (G).
- C-Pu-U: improved modeling of the full system.

IRSN Mephista-19 Nuclear Fuels Database (MEPH19)

Overview Including Phase and System Information

Available Starting with Thermo-Calc Version 2021a

Document created 11/13/2020

Contents

Overview of Mephista-19

November 12, 2020

1 General Description

1.1 Atoms

14 + 2 atoms

U, Pu, O	fuel
Fe, Si, C, Zr	cladding
Ba, La, Ru, Sr, Cs, Mo, Ce	fission products
Ar, H	gas

1.2 Stoichiometric Condensed Phases

LatSubSol name	TDB name
BA1C2(S)	**BA1C2**
BA1C1O3(C)	**BA1C1O3**
BA1CE1O3(S)	**BA1CE1O3**
BA1CS2MO2O8(S)	**BA1CS2MO2O8**
BA1FE2O4(S)	**BA1FE2O4**
BA1FE12O19(S)	**BA1FE12O19**
BA2FE2O5(S)	**BA2FE2O5**
BA2FE6O11(S)	**BA2FE6O11**
BA7FE4O13(S)	**BA7FE4O13**
BA1H2(C)	**BA1H2**
BA1H2O2(C)	**BA1H2O2**
BA1LA2O4(S)	**BA1LA2O4**
BA1MO1O4(S)	**BA1MO1O4**
BA1MO2O7(S)	**BA1MO2O7**
BA2MO1O5(S)	**BA2MO1O5**
BA3MO1O6(S)	**BA3MO1O6**
BA1O2(S)	**BA1O2**
BA1O3SI1(S)	**BA1O3SI1**
BA1O5SI2(S)	**BA1O5SI2**
BA2O4SI1(S)	**BA2O4SI1**
BA2O8SI3(S)	**BA2O8SI3**
BA3O5SI1(S)	**BA3O5SI1**
BA3O13SI5(S)	**BA3O13SI5**
BA5O21SI8(S)	**BA5O21SI8**
BA1O4U1(S)	**BA1O4U1**
BA1SI1(S)	**BA1SI1**
BA1SI2(S)	**BA1SI2**
BA2SI1(S)	**BA2SI1**
BA3SI4(S)	**BA3SI4**
BA5SI3(S)	**BA5SI3**

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LatSubSol name	TDB name
C1(GRA_HEX_A9)	C
C2CE1(S)	C2CE1
C3CE2(S)	C3CE2
C8CS1(S)	C8CS1
C10CS1(S)	C10CS1
C24CS1(S)	C24CS1
C36CS1(S)	C36CS1
C48CS1(S)	C48CS1
C60CS1(S)	C60CS1
C1CS2O3(S)	C1CS2O3
C1FE1O3(S)	C1FE1O3
C5FE1O5(L)	C5FE1O5
C1H4(L)	C1H4
C2H6(L)	C2H6
C3H6(L)	C3H6
C3H8(L)	C3H8
C1H2O2(L)	C1H2O2
C1H4O1(L)	C1H4O1
C2H4O2(L)	C2H4O2
C2H6O1(L)	C2H6O1
C2H6O2(L)	C2H6O2
C3H6O1(L)	C3H6O1
C3H6O2(L)	C3H6O2
C3H8O1(L)	C3H8O1
C3H8O3(L)	C3H8O3
C2LA1(LT)	C2LA1
C1MO1(SHP)	C1MO1
C1MO1O6(S)	C1MO1O6
C6MO1O6(S)	C6MO1O6
C1.7MO1U1(S)	C17MO1U1
C2MO1U1(S)	C2MO1U1
C1O3SR1(C)	C1O3SR1
C1O5U1(S)	C1O5U1
C0.4PU0.6(S)	C04PU06
C2RU1U2(S)	C2RU1U2
C1SI1(S)	C1SI1
C2SI2U3(T1)	C2SI2U3
C3SI16U20(T2)	C3SI16U20
C2SR1(S)	C2SR1
CE1FE2(S)	CE1FE2
CE2FE17(S)	CE2FE17
CE1FE1O3(S)	CE1FE1O3
CE1MO2O8(S)	CE1MO2O8
CE2MO3O13(S)	CE2MO3O13
CE2O5SI1(S)	CE2O5SI1
CE2O7SI2(S)	CE2O7SI2
CE14O39SI9(S)	CE14O39SI9

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LatSubSol name	TDB name
CE1O3SR1(S)	CE1O3SR1
CE2O7ZR2(S)	CE2O7ZR2
CE1RU2(S)	CE1RU2
CE3RU1(S)	CE3RU1
CE4RU3(S)	CE4RU3
CE7RU3(S)	CE7RU3
CE16RU9(S)	CE16RU9
CE1SI1(S)	CE1SI1
CE1SI2(S)	CE1SI2
CE3SI2(S)	CE3SI2
CE3SI5(S)	CE3SI5
CE5SI3(S)	CE5SI3
CE5SI4(S)	CE5SI4
CS1(BCC_A2)	CS
CS1H1(S)	CS1H1
CS1H1O1(C)	CS1H1O1
CS2MO2O7(S)	CS2MO2O7
CS2MO3O10(S)	CS2MO3O10
CS2MO4O13(S)	CS2MO4O13
CS2MO5O16(S)	CS2MO5O16
CS2MO7O22(S)	CS2MO7O22
CS1O2(S)	CS1O2
CS2O1(S)	CS2O1
CS2O2(S)	CS2O2
CS7O1(S)	CS7O1
CS2O4RU1(S)	CS2O4RU1
CS2O3SI1(C)	CS2O3SI1
CS2O5SI2(C)	CS2O5SI2
CS2O9SI4(C)	CS2O9SI4
CS2O3.56U1(S)	CS2O356U1
CS2O4U1(S)	CS2O4U1
CS2O7U2(S)	CS2O7U2
CS2O12U4(S)	CS2O12U4
CS2O13U4(S)	CS2O13U4
CS2O16U5(S)	CS2O16U5
CS2O18U6(S)	CS2O18U6
CS2O22U7(S)	CS2O22U7
CS2O27U9(S)	CS2O27U9
CS2O46U15(S)	CS2O46U15
CS4O17U5(S)	CS4O17U5
CS2O3ZR1(S)	CS2O3ZR1
CS4O4ZR1(S)	CS4O4ZR1
CS4O16ZR7(S)	CS4O16ZR7
CS6O17ZR7(S)	CS6O17ZR7
FE1H1O2(S)	FE1H1O2
FE1H2O2(S)	FE1H2O2
FE1H3O3(S)	FE1H3O3

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LatSubSol name	TDB name
FE2H2O4(S)	FE2H2O4
FE1LA1O3(S)	FE1LA1O3
FE12LA1O19.5(S)	FE12LA1O195
FE2MO1(LAVES)	FE2MO1
FE1MO1O4(S)	FE1MO1O4
FE1O1.5(S)	FE1O15
FE3O4(S)	FE3O4
FE1O3SI1(WOLLASTONITE)	FE1O3SI1
FE2O4SI1(FAYALITE)	FE2O4SI1
FE2O5SR2(S)	FE2O5SR2
FE2O6SR3(S)	FE2O6SR3
FE10O22SR7(S)	FE10O22SR7
FE12O19SR1(S)	FE12O19SR1
FE1O4U1(S)	FE1O4U1
FE1SI1(S)	FE1SI1
FE1SI2(S)	FE1SI2
FE2SI1(S)	FE2SI1
FE3SI7(S)	FE3SI7
FE5SI3(S)	FE5SI3
FE4U3ZR5(e)	FE4U3ZR5
FE6U71ZR23(l)	FE6U71ZR23
FE25U9ZR16(k)	FE25U9ZR16
FE1ZR2(S)	FE1ZR2
FE1ZR3(S)	FE1ZR3
FE73ZR27(S)	FE73ZR27
H2LA1(S)	H2LA1
H3LA1O3(S)	H3LA1O3
H2O1(L)	H2O1
H2O2SR1(C)	H2O2SR1
H2O4U1(S)	H2O4U1
H4O5U1(S)	H4O5U1
H2PU1(S)	H2PU1
H3PU1(S)	H3PU1
H6SI2(S)	H6SI2
H2SR1(C)	H2SR1
H3U1(S)	H3U1
H2ZR1(S)	H2ZR1
LA2MO3O12(S)	LA2MO3O12
LA2O5SI1(S)	LA2O5SI1
LA2O7SI2(S)	LA2O7SI2
LA4O12SI3(S)	LA4O12SI3
LA4O7SR1(S)	LA4O7SR1
LA4O9SR3(S)	LA4O9SR3
LA2O5ZR1(S)	LA2O5ZR1
LA2O7ZR2(S)	LA2O7ZR2
LA1RU2(S)	LA1RU2
LA3RU1(S)	LA3RU1

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LatSubSol name	TDB name
LA5RU2(S)	LA5RU2
LA5RU3(S)	LA5RU3
LA7RU3(S)	LA7RU3
LA1SI1(S)	LA1SI1
LA1SI2(S)	LA1SI2
LA3SI2(S)	LA3SI2
MO1O2(S)	MO1O2
MO1O2.75(S)	MO1O275
MO1O2.875(S)	MO1O2875
MO1O2.889(S)	MO1O2889
MO1O3(S)	MO1O3
MO1O4SR1(S)	MO1O4SR1
MO2O8ZR1(S)	MO2O8ZR1
MO0.333SI0.667(C11)	MO0333SI0667
MO0.75SI0.25(M1MO3)	MO075SI025
MO1U2(S)	MO1U2
O3PU2(HEXAGONAL)	O3PU2
O3.04PU2(S)	O304PU2
O2RU1(S)	O2RU1
O2SI1(CRISTOBALITE)	O2SI1_1
O2SI1(H_T_QUARTZ)	O2SI1_2
O2SI1(L_T_QUARTZ)	O2SI1_3
O2SI1(TRIDYMITE)	O2SI1_4
O3SI1SR1(S)	O3SI1SR1
O4SI1SR2(S)	O4SI1SR2
O5SI1SR3(S)	O5SI1SR3
O2SR1(S)	O2SR1
O4SR2ZR1(S)	O4SR2ZR1
O7SR3ZR2(S)	O7SR3ZR2
O3U1(S)	O3U1
O8U3(S)	O8U3
O9U4(S)	O9U4
PU1RU1(S)	PU1RU1
PU1RU2(S)	PU1RU2
PU3RU1(S)	PU3RU1
PU5RU3(S)	PU5RU3
PU19RU1(S)	PU19RU1
PU1SI1(S)	PU1SI1
PU1SI2(S)	PU1SI2
PU3SI2(S)	PU3SI2
PU3SI5(S)	PU3SI5
PU5SI3(S)	PU5SI3
RU1SI1(S)	RU1SI1
RU2SI1(S)	RU2SI1
RU2SI3(S)	RU2SI3
RU4SI3(S)	RU4SI3
RU5SI3(S)	RU5SI3

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LatSubSol name	TDB name
RU1U2(S)	**RU1U2**
RU4U3(S)	**RU4U3**
RU5U3(S)	**RU5U3**
RU12U13(S-L)	**RU12U13_1**
RU12U13(S-H)	**RU12U13_2**
RU1ZR1(S)	**RU1ZR1**
RU2ZR1(S)	**RU2ZR1**
SI1SR1(S)	**SI1SR1**
SI1SR2(S)	**SI1SR2**
SI2SR1(S-A)	**SI2SR1**
SI3SR5(S)	**SI3SR5**
SI1U3(HIGH_T)	**SI1U3_1**
SI1U3(LOW_T)	**SI1U3_2**
SI1.88U1(S)	**SI188U1**
SI3U1(S)	**SI3U1**
SI5U3(S)	**SI5U3**
SI511U489(S)	**SI511U489**
SI1ZR1(S)	**SI1ZR1**
SI1ZR2(S)	**SI1ZR2**
SI1ZR3(S)	**SI1ZR3**
SI2ZR1(S)	**SI2ZR1**
SI2ZR3(S)	**SI2ZR3**
SI3ZR5(S)	**SI3ZR5**
SI4ZR5(S)	**SI4ZR5**

1.3 Condensed Solutions

LatSubSol name	mult	atoms	TDB name
ALPHA	1	Pu, Zr	**ALPHA**
BCC	1	O, Pu	**BCC**
BCC_A2	3	Ba, C, Ce, Fe, La, Mo, Pu, Ru, Si, Sr, U, Zr, O	**BCCA2**
BCT	1	C, U, O	**BCT**
BETA	1	Pu, U, Zr	**BETA**
C-FE-MO(KSI)	1	C, Fe, Mo	**CFEMOKSI**
C-FE-MO(M3C1_CEM)	1	C, Fe, Mo	**CFEMOM3C1CEM**
C-FE-MO(M6C1)	1	C, Fe, Mo	**CFEMOM6C1**
C-MO(ETA)	1	C, Mo	**CMOETA**
C-PHASE	1	Ce, O	**CPHASE**
C-PU-U(M2C3)	1	C, Pu, U	**CPUUM2C3**
C2LA(1+x)(HT)	1	C, La	**C2LA1xHT**
C3LA(2+x)	1	C, La	**C3LA2x**
CC	1	Ba, O, Ce, La, Sr, Zr	**CC**
CE-LA(DHCP)	1	Ce, La	**CELADHCP**
CE1O1.5(SS)	1	Ce, O, Zr	**CE1O15SS**
CS2MOO4(SS)	1	Ba, Mo, O, Cs	**CS2MOO4SS**
CxRU3U1(SS)	1	C, Ru, U	**CxRU3U1SS**

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LatSubSol name	mult	atoms	TDB name
DELTA	1	U, Zr	**DELTA**
DIA_A4	1	Ru, Si, Sr	**DIAA4**
DZETA	1	Pu, U, Zr	**DZETA**
ETA	1	Pu, U, Zr	**ETA**
FCC_A1	2	Ba, C, Ce, Fe, La, Mo, Pu, Ru, Si, Sr, U, Zr	**FCCA1**
FCC_B1	2	Ba, O, Fe, Sr	**FCCB1**
FCC_B1(4)	2	C, Pu, U, Zr, O	**FCCB14**
FCC_C1	2	Ba, O, Ce, Fe, La, U, Sr, Pu, Zr	**FCCC1**
FE-MO(MU)	1	Fe, Mo	**FEMOMU**
FE-MO(R)	1	Fe, Mo	**FEMOR**
FE-MO(SIGMA)	1	Fe, Mo	**FEMOSIGMA**
FE1M6	1	Fe, Pu, U	**FE1M6**
GAMMA	1	Pu, U, Zr	**GAMMA**
HCP_A3	2	C, Fe, La, Mo, Pu, Ru, U, Zr, O	**HCPA3**
LAVES	2	Fe, Pu, U, Zr	**LAVES**
LIQUID	3	Ba, O, Mo, C, Ce, Cs, Fe, La, Pu, Si, Sr, U, Zr, Ru	**LIQUID**
MO-RU(SIGMA1)	1	Mo, Ru	**MORUSIGMA1**
MO-SI(MO5SI3)	1	Mo, Si	**MOSIMO5SI3**
MO-ZR(C15)	1	Mo, Zr	**MOZRC15**
MONOCLINIC	1	Ce, O, Pu, Zr	**MONOCLINIC**
ORT_A20	1	Fe, Pu, Si, U, Zr	**ORTA20**
PEROVSKITE	2	Ba, Mo, O, Pu, U, Zr, Sr	**PEROVSKITE**
SI2SR-B	1	Si, Sr	**SI2SRB**
SI2U3(SS)	1	C, Si, U	**SI2U3SS**
TCHERNOBYLITE	1	O, Si, U, Zr	**TCHERNOBYLITE**
TET(METAL)	1	Fe, Mo, Pu, Ru, Si, U, Zr	**TETMETAL**
TET(OXIDE)	1	Ba, O, Ce, Fe, La, Pu, U, Zr	**TETOXIDE**
TETA	1	Pu, Zr	**TETA**
TET_A6	1	Pu, U, Zr	**TETA6**

1.4 Gas

LatSubSol name	TDB name
AR1(G)	**AR**
BA1(G)	**BA**
BA1H1(G)	**BA1H1**
BA1H1O1(G)	**BA1H1O1**
BA1H2O2(G)	**BA1H2O2**
BA1MO1O4(G)	**BA1MO1O4**
BA1O1(G)	**BA1O1**
BA2O1(G)	**BA2O1**
C1(G)	**C**
C2(G)	**C2**
C3(G)	**C3**
C4(G)	**C4**
C5(G)	**C5**

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LatSubSol name	TDB name
C5FE1O5(G)	C5FE1O5
C1H1(G)	C1H1
C1H2(G)	C1H2
C1H3(G)	C1H3
C1H4(G)	C1H4
C2H1(G)	C2H1
C2H2(G)	C2H2
C2H3(G)	C2H3
C2H4(G)	C2H4
C2H5(G)	C2H5
C2H6(G)	C2H6
C3H4(G)1	C3H4_1
C3H4(G)2	C3H4_2
C3H4(G)3	C3H4_3
C3H6(G)1	C3H6_1
C3H6(G)2	C3H6_2
C3H7(G)1	C3H7_1
C3H7(G)2	C3H7_2
C3H8(G)	C3H8
C1H1O1(G)	C1H1O1
C1H1O2(G)	C1H1O2
C1H2O1(G)	C1H2O1
C1H2O2(G)C	C1H2O2_1
C1H2O2(G)T	C1H2O2_2
C1H3O1(G)1	C1H3O1_1
C1H3O1(G)2	C1H3O1_2
C1H4O1(G)	C1H4O1
C2H2O1(G)	C2H2O1
C2H2O2(G)	C2H2O2
C2H4O1(G)1	C2H4O1_1
C2H4O1(G)2	C2H4O1_2
C2H4O2(G)1	C2H4O2_1
C2H4O2(G)2	C2H4O2_2
C2H4O4(G)	C2H4O4
C2H6O1(G)1	C2H6O1_1
C2H6O1(G)2	C2H6O1_2
C2H6O2(G)	C2H6O2
C3H4O1(G)1	C3H4O1_1
C3H4O1(G)2	C3H4O1_2
C3H4O1(G)3	C3H4O1_3
C3H4O2(G)1	C3H4O2_1
C3H4O2(G)2	C3H4O2_2
C3H4O3(G)	C3H4O3
C3H6O1(G)1	C3H6O1_1
C3H6O1(G)2	C3H6O1_2
C3H6O1(G)3	C3H6O1_3
C3H6O1(G)4	C3H6O1_4

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LatSubSol name	TDB name
C3H6O1(G)5	C3H6O1_5
C3H6O2(G)	C3H6O2
C3H6O3(G)	C3H6O3
C3H8O1(G)1	C3H8O1_1
C3H8O1(G)2	C3H8O1_2
C3H8O1(G)3	C3H8O1_3
C2H6O1SI1(G)	C2H6O1SI1
C2H8SI1(G)	C2H8SI1
C6MO1O6(G)	C6MO1O6
C1O1(G)	C1O1
C1O2(G)	C1O2
C2O1(G)	C2O1
C3O2(G)	C3O2
C1SI1(G)	C1SI1
C1SI2(G)	C1SI2
C1SI3(G)	C1SI3
C1SI4(G)	C1SI4
C2SI1(G)	C2SI1
C2SI2(G)	C2SI2
C2SI3(G)	C2SI3
CE1(G)	CE
CE1O1(G)	CE1O1
CS1(G)	CS
CS2(G)	CS2
CS1H1(G)	CS1H1
CS1H1O1(G)	CS1H1O1
CS2H2O2(G)	CS2H2O2
CS2MO1O4(G)	CS2MO1O4
CS1O1(G)	CS1O1
CS2O1(G)	CS2O1
CS2O2(G)	CS2O2
CS2O4RU1(G)	CS2O4RU1
FE1(G)	FE
FE2(G)	FE2
FE1H2O2(G)	FE1H2O2
FE1O1(G)	FE1O1
H1(G)	H
H2(G)	H2
H1MO3(G)	H1MO3
H1MO1O1(G)	H1MO1O1
H2MO1O2(G)	H2MO1O2
H2MO1O4(G)	H2MO1O4
H1O1(G)	H1O1
H1O2(G)	H1O2
H2O1(G)	H2O1
H2O2(G)	H2O2
H1O1RU1(G)	H1O1RU1

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LatSubSol name	TDB name
H2O2RU1(G)	H2O2RU1
H2O3SI1(G)	H2O3SI1
H4O4SI1(G)	H4O4SI1
H1O1SR1(G)	H1O1SR1
H2O2SR1(G)	H2O2SR1
H1SI1(G)	H1SI1
H2SI1(G)	H2SI1
H3SI1(G)	H3SI1
H4SI1(G)	H4SI1
H6SI2(G)	H6SI2
H1SR1(G)	H1SR1
H1ZR1(G)	H1ZR1
LA1(G)	LA
LA1O1(G)	LA1O1
LA2O1(G)	LA2O1
LA2O2(G)	LA2O2
MO1(G)	MO
MO1O1(G)	MO1O1
MO1O2(G)	MO1O2
MO1O3(G)	MO1O3
MO2O6(G)	MO2O6
MO3O9(G)	MO3O9
MO4O12(G)	MO4O12
MO5O15(G)	MO5O15
O1(G)	O
O2(G)	O2
O3(G)	O3
O1PU1(G)	O1PU1
O2PU1(G)	O2PU1
O1RU1(G)	O1RU1
O2RU1(G)	O2RU1
O3RU1(G)	O3RU1
O4RU1(G)	O4RU1
O1SI1(G)	O1SI1
O2SI1(G)	O2SI1
O2SI2(G)	O2SI2
O1SR1(G)	O1SR1
O1U1(G)	O1U1
O2U1(G)	O2U1
O3U1(G)	O3U1
O1ZR1(G)	O1ZR1
O2ZR1(G)	O2ZR1
PU1(G)	PU
RU1(G)	RU
SI1(G)	SI
SI2(G)	SI2
SI3(G)	SI3

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LatSubSol name	TDB name
SR1 (G)	**SR**
SR2 (G)	**SR2**
U1 (G)	**U**
ZR1 (G)	**ZR**
ZR2 (G)	**ZR2**

2 Assessed Systems

2.1 Binary Systems

assessed binary systems						
Ba – C	Ba – Ce	Ba – Cs	Ba – Fe	Ba – La	Ba – Mo	Ba – O
Ba – Pu	Ba – Ru	Ba – Si	Ba – Sr	Ba – U	Ba – Zr	C – Ce
C – Cs	C – Fe	C – La	C – Mo	C – O	C – Pu	C – Ru
C – Si	C – Sr	C – U	C – Zr	Ce – Cs	Ce – Fe	Ce – La
Ce – Mo	Ce – O	Ce – Pu	Ce – Ru	Ce – Si	Ce – Sr	Ce – U
Ce – Zr	Cs – Fe	Cs – La	Cs – Mo	Cs – O	Cs – Pu	Cs – Ru
Cs – Si	Cs – Sr	Cs – U	Cs – Zr	Fe – La	Fe – Mo	Fe – O
Fe – Pu	Fe – Ru	Fe – Si	Fe – Sr	Fe – U	Fe – Zr	La – Mo
La – O	La – Pu	La – Ru	La – Si	La – Sr	La – U	La – Zr
Mo – O	Mo – Pu	Mo – Ru	Mo – Si	Mo – Sr	Mo – U	Mo – Zr
O – Pu	O – Ru	O – Si	O – Sr	O – U	O – Zr	Pu – Ru
Pu – Si	Pu – Sr	Pu – U	Pu – Zr	Ru – Si	Ru – Sr	Ru – U
Ru – Zr	Si – Sr	Si – U	Si – Zr	Sr – U	Sr – Zr	U – Zr

2.2 Ternary Systems

system	assessed sub-systems
Ba – Ce – O	$BaO - CeO_2$
Ba – Fe – O	$BaO - FeO$ $BaO - Fe_2O_3$
Ba – La – O	$BaO - La_2O_3$
Ba – Mo – O	$BaO - MoO_3$
Ba – O – Si	$BaO - SiO_2$
Ba – O – Sr	$BaO - SrO$
Ba – O – U	$BaO - UO_2$
Ba – O – Zr	$BaO - ZrO_2$
Ba – O – Pu	$BaO - PuO_2$
C – Fe – Mo	full
C – O – U	full
C – O – Zr	full
C – O – Pu	full
C – U – Zr	full
C – U – Pu	full

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system	assessed sub-systems
Ce – O – La	$CeO_2 - La_2O_3$
Ce – O – Mo	$CeO_2 - MoO_3$ $Ce_2O_3 - MoO_3$
Ce – O – Pu	$CeO_2 - PuO_2$ $Ce_2O_3 - PuO_2$
Ce – O – Si	$Ce_2O_3 - SiO_2$
Ce – O – Sr	$CeO_2 - SrO$
Ce – O – U	$CeO_2 - UO_2$ $Ce_2O_3 - UO_2$
Ce – O – Zr	$CeO_2 - ZrO_2$ $Ce_2O_3 - ZrO_2$
Cs – Mo – O	$Cs_2MoO_4 - MoO_3$
Fe – La – O	$FeO - La_2O_3$ $Fe_2O_3 - La_2O_3$
Fe – O – Pu	full
Fe – O – Si	$FeO - Fe_2O_3 - SiO_2$
Fe – O – Sr	$FeO - SrO$ $Fe_2O_3 - SrO$
Fe – O – U	full
Fe – O – Zr	full
Fe – Pu – U	full
Fe – Pu – Zr	full
Fe – U – Zr	full
La – O – Pu	$La_2O_3 - PuO_2$
La – O – Si	$La_2O_3 - SiO_2$
La – O – Sr	$La_2O_3 - SrO$
La – O – U	$La_2O_3 - UO_2$
La – O – Zr	$La_2O_3 - ZrO_2$
Mo – O – Pu	$MoO_3 - PuO_2$
Mo – O – Zr	$MoO_3 - ZrO_2$
O – Pu – Si	$SiO_2 - PuO_2$
O – Pu – Sr	$SrO - PuO_2$
O – Pu – U	full
O – Pu – Zr	full
O – Si – Sr	$SrO - SiO_2$
O – Si – U	$SiO_2 - UO_2$
O – Si – Zr	$SiO_2 - ZrO_2$
O – Sr – U	$SrO - UO_2$
O – Sr – Zr	$SrO - ZrO_2$
O – U – Zr	full
Pu – U – Zr	full

2.3 Quaternary Systems

system	assessed sub-systems
Ba – Cs – Mo – O	$BaMoO_4 - Cs_2MoO_4$
O – Si – U – Zr	$SiO_2 - UO_2 - ZrO_2$