MEPH15: IRSN Mephista Nuclear Fuels Database

Database name:	IRSN Mephista Nuclear Fuels Database	*Database acronym:*	MEPH
Database owner:	IRSN	*Database version:*	15.1

The MEPH15 (IRSN Mephista-15_1) database contains critically-assessed and internally-consistent thermodynamic data for the entire field from metal to oxide domains within a 14-element framework + H-Ar (only for the gaseous phase, as well as for hydrides and hydrous oxides/silicates). It can be applied to successfully study fundamental scientific issues and efficiently investigate practical engineering problems in new generation of 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, for improving the predictions and treatments of operational accidents, and for assisting the assessment and processing of nuclear fuel and waste managements.

Elements (14+2)

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

Phases and Assessed Subsystems

Available solution and stoichiometric phases:

Condensed solution phases:	*(solids/liquid phases)*	46 phases
Condensed stoichiometric phases:	*(solid/liquid substances)*	236 phases
Gaseous mixture phase	*(ideal gaseous mixture)*	157 gaseous species

Note: 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 & hydroxides, silicates & hydrous silicates, hydrides, carbides & 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)*	16
Pseudo-Binary subsystems:	*(oxides, silicates)*	43
Pseudo-Ternary subsystems:	*(oxides, silicates)*	2

Note: 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, quaternary 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.