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**Database name:** NIST Solder solutions database  
**Database acronym:** USLD1  
**Database owner:** NIST  
**Database segment:** Solder Alloys

**Database version:** 1.2

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### Brief description

Database for solder alloy solution phases.

### Applications

Thermodynamic calculations of Pb-containing or Pb-free solder systems.

### Included Elements

Ag Bi Cu Pb Sb Sn

### Included Phases

BCC_A2	CU3SN	CU6SN5_L	FCC_A1	RHOMBO_A7
BCT_A5	CU41SN11	DO3	HCP_A3	SB2SN3
CU10SN3	CU6SN5	EPSILON	LIQUID:L	SBSN

### Assessed Systems

Critically assessed binary systems:

Ag-Bi, Ag-Cu, Ag-Pb, Ag-Sb, Ag-Sn, Bi-Cu, Bi-Pb, Bi-Sn, Cu-Pb, Cu-Sn, Pb-Sn, Sb-Sn

Critically assessed ternary systems:

Ag-Bi-Cu, Ag-Bi-Pb, Ag-Bi-Sn, Ag-Cu-Pb, Ag-Cu-Sn, Ag-Pb-Sn, Ag-Sb-Sn, Bi-Cu-Pb, Bi-Cu-Sn, Bi-Pb-Sn, Cu-Pb-Sn

Note that some Sb-bearing subsystems are not yet fully implemented or completely assessed. In the next release this will be improved. Further updated versions of this database are now under continuous developments at NIST, for the inclusions of more alloying elements (*e.g.*, Al-Au-In-Ga-Ge-Si-Zn).

### Validation

This solder alloy solution database can be used to predict various thermodynamic properties, and to show the effects of non-equilibrium solidification. The results from these predictions can be used to eliminate candidate solder alloys for which the calculations reveal unsuitable freezing temperature and range from further testing. Different types of calculated systems have been distinguished in the development of this solder alloy solution database:

- *Critically assessed systems:* A critical evaluation of available experimental data was used to derive a proper thermodynamic description of the multicomponent system. If such experimental data were only available or considered for part of the system, then a partial assessment is possible.
- *Extrapolated systems:* The analytical descriptions of constituent subsystems are combined and used to predict the multicomponent system, even for compositions and temperatures which have not been experimentally evaluated. Depending on the complexity of the multicomponent system, 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.

### Scientific Models & References

See the Thermo-Calc Software reference list available at: <http://www.thermocalc.com/Library.htm>