

TCS Cu-alloys Mobility Database (MOBCU6)

Technical Information

Available Starting with Thermo-Calc Version 2026b



Contents

MOBCU6: TCS Cu-based Alloys Mobility Database	3
<i>The CALPHAD Method</i>	3
<i>Learn More</i>	4
MOBCU6 Elements and Phases	5
<i>Included Elements</i>	5
<i>Included Phases</i>	5
<i>Limits</i>	6
MOBCU6 Assessed Binary Systems	7
<i>BCC_A2</i>	7
<i>HCP_A3</i>	7
<i>FCC_A1</i>	7
<i>LIQUID</i>	8
<i>Intermetallic Phases</i>	8
MOBCU6 Assessed Ternary Systems	9
<i>FCC_A1</i>	9
MOBCU6 Assessed Quaternary Systems	10
<i>FCC_A1</i>	10
MOBCU6 Models for the Included Phases	11
MOBCU: TCS Copper Mobility Database Revision History	12
<i>MOBCU5 to MOBCU6</i>	12
<i>MOBCU4 to MOBCU5</i>	12
<i>MOBCU3 to MOBCU4</i>	13
<i>MOBCU2 TO MOBCU3</i>	13
<i>MOBCU1 to MOBCU2</i>	13

MOBCU6: TCS Cu-based Alloys Mobility Database

TCS Cu-based Alloys Mobility Database (MOBCU) is a kinetic database containing mobility data for Cu-based alloys. Data is present in a format suitable for simulation of diffusion controlled phenomena using the add-on Diffusion Module (DICTRA) and/or Precipitation Module (TC-PRISMA), and/or for use together with any Thermo-Calc programming interface.

MOBCU6 is intended for use in combination with the TCCU7 (TCS Cu-based Alloys) thermodynamic database.

Together with the Diffusion Module (DICTRA) and a thermodynamic database for Cu-alloys (e.g. TCCU) use the MOBCU6 database to study diffusion-controlled phenomena in copper alloys, e.g. microsegregation during solidification, homogenization kinetics, growth/dissolution kinetics of precipitates, interdiffusion, and so forth. You can also use it with the Precipitation Module (TC-PRISMA) to simulate concurrent nucleation, growth, and coarsening of precipitates in Cu-based alloys.



[MOBCU: TCS Copper Mobility Database Revision History](#). The current version of the database is MOBCU6. See the link for any subversion release details.

| The CALPHAD Method

The Thermo-Calc databases are developed with the CALPHAD approach based on various types of experimental data and theoretical values (e.g. those from first-principles calculations). It is based on the critical evaluation of binary, ternary, and for some databases, important higher order systems. This enables predictions to be made for multicomponent systems and alloys of industrial importance. Among these, the thermodynamic database is of fundamental importance.



Learn more on our website about the [CALPHAD Method](#) and how it is applied to the Thermo-Calc databases. Also visit the video tutorials on our [website](#) or our [YouTube playlist](#).

Learn More



Go to the [Copper-based Alloys Databases](#) page on our website where you can access this *Technical Information* plus learn more about the compatible thermodynamic database and its *Validation and Calculation Examples Collection*. Also explore further [applications of Thermo-Calc to Copper](#) including links to resources such as examples, publications, and more.

MOBCU6 Elements and Phases

Included Elements

There are 34 elements included in the most recent version of the database.

Included Elements									
Ag	Al	Au	As	B	Be	Bi	C	Ca	Cd
Ce	Co	Cr	Cu	Fe	Ge	La	Mg	Mn	Mo
Nb	Ni	O	P	Pb	Pt	S	Se	Si	Sn
Ta	Ti	Zn	Zr						

Included Phases

This database includes 9 phases.

Included Phases				
BCC_A1	BCC_B2	FCC_A1	FCC_L12	GAMMA_D82
GAMMA_D83	HCP_A3	HCP_ZN	LIQUID	



The phases have diffusion data included in the database. You can include other phases in a diffusion simulation. However, these other phases are treated as so-called diffusion `NONE`, i.e. there is no diffusion considered in these other phases. Any phase not listed above is automatically entered as diffusion `NONE` (in Console Mode in the DICTRA module or in Graphical Mode with the Diffusion Module (DICTRA) and/or Precipitation Module (TC-PRISMA)), as long as a thermodynamic description for the phases is retrieved prior to reading data from the mobility database.

■ Limits

The database is applicable for most commercial Cu-based alloys; care should be taken with alloys including high amounts of alloying elements.

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.

MOBCU6 Assessed Binary Systems

BCC_A2

BCC_A2 Binary Assessed Systems

Al-Cu	Al-Fe	Al-Ni	Al-Ti	Cr-Fe	Cr-Mo	Cr-Ni	Cr-Ta
Cr-Ti	Cu-Fe	Cu-Sn	Cu-Ti	Cu-Zn	Fe-Mo	Fe-Ni	Fe-Si
Fe-Ti	Fe-Zn	Mn-Ti	Mn-Zr	Mo-Nb	Mo-Ta	Mo-Ti	Mo-Zr
Nb-Ta	Nb-Ti	Nb-Zr	Ni-Ti	Ta-Ti	Ta-Zr	Ti-Zr	

HCP_A3

HCP_A3 Binary Assessed Systems

Ag-Mg	Ag-Ti	Cu-Ti	Cu-Zn	Mg-Zn
-------	-------	-------	-------	-------

FCC_A1

Included are the complete and critical assessments for FCC_A1 in binary systems,

FCC_A1 Binary Assessed Systems

Ag-Al	Ag-Au	Ag-Cu	Ag-Sn	Al-Cr	Al-Cu	Al-Fe	Al-Mg
Al-Mn	Al-Ni	Al-Pt	Al-Si	Al-Ti	Al-Zn	Au-Cu	Be-Cu
Co-Cu	Co-Fe	Co-Mn	Co-Ni	Co-Pt	Cr-Fe	Cr-Ni	Cu-Fe
Cu-Mg	Cu-Mn	Cu-Ni	Cu-Si	Cu-Sn	Cu-Ti	Cu-Zn	Fe-Mn
Fe-Ni	Mn-Ni	Mn-Zn	Mo-Ni	Ni-Pt	Ni-Si	Ni-Ti	Ni-Zn

LIQUID

Data for diffusion in LIQUID Cu alloys are also assessed or estimated for all elements in the database. Complete and critical assessments of these binary systems for the LIQUID phase are included.

<i>LIQUID Binary Assessed Systems</i>							
Ag-Cu	Ag-Sn	Al-Ce	Al-Cu	Al-Mg	Al-Ni	Al-Si	Al-Zn
Ce-Cu	Cu-Sn	Fe-Mn	Fe-Si	Ni-P	Ni-Si	Pb-Sn	

Intermetallic Phases

For the following intermetallic phases, these are the assessed binary systems.

- GAMMA_D82: Fe-Zn
- GAMMA_D83: Cu-Zn

MOBCU6 Assessed Ternary Systems

FCC_A1

Included are the complete and critical assessments for FCC_A1 in ternary systems.

FCC_A1 Ternary Assessed Systems

Ag-Al-Cu	Ag-Au-Cu	Al-Cr-Ni	Al-Cu-Fe	Al-Cu-Mg	Al-Cu-Mn	Al-Cu-Ni	Al-Cu-Si
Al-Cu-Sn	Al-Cu-Zn	Al-Mn-Ni	Al-Ni-Pt	Al-Ni-Ti	C-Cr-Fe	C-Cr-Ni	C-Fe-Ni
Co-Cu-Mn	Co-Cu-Ni	Co-Fe-Ni	Cr-Cu-Ni	Cr-Fe-Ni	Cu-Fe-Mn	Cu-Fe-Ni	Cu-Mn-Ni
Cu-Mn-Si	Cu-Mn-Zn	Cu-Mo-Ni	Cu-Ni-Si	Cu-Ni-Sn	Cu-Ni-Ti	Cu-Ni-Zn	Cu-Sn-Zn

MOBCU6 Assessed Quaternary Systems

FCC_A1

Included are the complete and critical assessments for FCC_A1 in quaternary systems.

FCC_A1 Quaternary Assessed Systems

Cu-Al-Ni-Sn
Cu-Mn-Ni-Zn
Cu-Ni-Al-Zn

MOBCU6 Models for the Included Phases

Phase Name	Prototype	Strukturbericht	Pearson Symbol	Space Group	Info	Sublattices	Formula Unit
LIQUID	Liquid	-	-	-	-	1	(AG, CU, FE, GE, LA, MN, MNS, MO, NI, SI, ZN, ZNS, SN, SNS, CO, P, PB, PBS, , BE, AU, AL, AS, B, BI, C, CA, CD, CE, CR, CR3GE1, MG, MG2SN, NB, PT, S, SE, TA, TI, ZR, CU2S, , CU2SE, CU2O, CUO, AL2/3O1, AL4/3O2, CRO, CRO3/2, NI12P5, NIS, ZR1/2O1, FES, SIO2, , FEO, FEO3/2, MNO, MNO3/2)1
FCC_A1	Face-Centered Cubic (Cu, A1, fcc)	A1	cF4	(225, Fm-3m)	Metallic FCC_A1 solution, e.g. (Cu), (Al), (Ni)	2	(AG, AL, AU, AS, BE, BI, CA, CD, CE, CO, CR, CU, FE, GE, LA, MG, MN, MO, , NB, NI, P, PB, PT, S, SE, SI, SN, TA, TI, ZN, ZR)1(B, C, O, VA)1
FCC_L12	Bogdanovite (Cu3Au, L12)	L12	cP4	(221, Pm-3m)	-	3	(AL, CU, CE, FE, GE, LA, MG, MN, MO, NI, SI, ZN, CR, SN, TA, TI, ZR, , AG, CA, CO, PB, BE, BI, CD, P, AU, AS, NB, PT, S, SE)0.75(AL, CU, FE, GE, CE, LA, MG, MN, MO, NI, SI, ZN, CR, SN, TA, TI, ZR, , AG, CA, CO, PB, BE, BI, CD, P, AU, AS, NB, PT, S, SE)0.25(B, C, O, VA)1
BCC_A2	Body-Centered Cubic (W, A2, bcc)	A2	cI2	(229, Im-3m)	Metallic BCC_A2 solution	2	(AG, AL, AU, AS, BE, BI, CA, CD, CE, CO, CR, CU, FE, GE, LA, MG, MN, MO, , NB, NI, P, PB, PT, S, SE, SI, SN, TA, TI, ZN, ZR, VA)1(B, C, O, VA)3
BCC_B2	CsCl (B2)	B2	cP2	(221, Pm-3m)	-	3	(AG, AL, AU, AS, BE, BI, CA, CD, CE, CO, CR, CU, FE, GE, LA, MG, MN, MO, , NB, NI, P, PB, PT, S, SE, SI, SN, TA, TI, ZN, ZR, VA)0.5(AG, AL, AU, AS, BE, BI, CA, CD, CE, CO, CR, CU, FE, GE, LA, MG, MN, MO, , NB, NI, P, PB, PT, S, SE, SI, SN, TA, TI, ZN, ZR, VA)0.5(B, C, O, VA)3
HCP_A3	Hexagonal Close Packed (Mg, A3, hcp)	A3	hP2	(194, P6_3/mmc)	Metallic HCP_A3 solution, alpha_Mg/Hf/Sc/Ti/Zr	2	(AG, AL, AU, AS, BE, BI, CA, CD, CE, CO, CR, CU, FE, GE, LA, MG, MN, MO, NB, , NI, PB, PT, S, SI, SN, TA, TI, ZN, ZR)1(B, C, O, VA)0.5
GAMMA_D83	gamma-brass (Cu9Al4, D83)	D83	cP52	(215, P-43m)	solution between Al8Cu5 (rt) and Cu5Zn8	3	(AL, FE, NI, SI, SN, ZN)4(AL, CU, NI, SI, ZN)1(CU, MN, FE, NI, ZN, SN)8
GAMMA_D82	gamma-Brass (Cu5Zn8, D82)	D82	cI52	(217, I-43m)	-	4	(FE, MN, ZN)2(FE, MN, NI, ZN)2(AL, CU, FE, MN, NI, SI, ZN)3(AL, ZN)6
HCP_ZN	Hexagonal Close Packed (Mg, A3, hcp)	A3	hP2	(194, P6_3/mmc)	-	2	-

MOBCU: TCS Copper Mobility Database Revision History

Current Database Version

Database name (acronym):	TCS Cu-based Alloys Mobility Database (MOBCU)
Database owner:	Thermo-Calc Software AB
Database version:	6.0
First release:	MOBCU1 was released with 2016a

MOBCU5 to MOBCU6

Software release version: 2026b (June 2026)

Elements and Phases

- Two new elements added: S and Ta (34 elements total).
- Six new phases have been added: BCC_A2, BCC_B2, HCP_A3, HCP_ZN, GAMMA_D82, and GAMMA_D83. This is in addition to the existing phases FCC_A1, FCC_L12, and LIQUID.

Binary Systems

- **BCC_A2 phase:** 31 binary systems phase are added: Al-Cu, Al-Fe, Al-Ni, Al-Ti, Cr-Fe, Cr-Mo, Cr-Ni, Cr-Ta, Cr-Ti, Cu-Fe, Cu-Sn, Cu-Ti, Cu-Zn, Fe-Mo, Fe-Ni, Fe-Si, Fe-Ti, Fe-Zn, Mn-Ti, Mn-Zr, Mo-Nb, Mo-Ta, Mo-Ti, Mo-Zr, Nb-Ta, Nb-Ti, Nb-Zr, Ni-Ti, Ta-Ti, Ta-Zr, Ti-Zr.
- **HCP_A3 phase:** A total of 5 binary systems for the HCP_A3 phase are added: Ag-Mg, Ag-Ti, Cu-Ti, Cu-Zn, Mg-Zn.
- **GAMMA_D82 phase:** Interaction parameters for the Fe-Zn system are assessed.
- **GAMMA_D83 phase:** Interaction parameters for the Cu-Zn system are assessed.

MOBCU4 to MOBCU5

Software release version: 2022b (June 2022)

This database is compatible with TCS Cu-based Alloys Database (TCCU5).

- Two new elements: Ce and La.
- The self-diffusion and related impurity diffusion data for Ce and La were included in both FCC_A1 and LIQUID phases.
- The complete and critical assessments for the following systems are implemented:
 - FCC Cu-Ti, Co-Mn, Ni-Mo, Cu-Ni-Mo, Cu-Ni-Ti, Cu-Co-Mn, Cu-Mn-Si, Cu-Ni-Al-Zn and Cu-Ni-Al-Sn.
 - Liquid: Al-Ce and Cu-Ce.
- The description for FCC Ni-Ti is updated.

MOBCU3 to MOBCU4

Software release version: 2021b (June 2021)

This database is compatible with TCS Cu-based Alloys Database (TCCU4).

The complete and critical assessments for FCC Cu-Al-Sn and Cu-Ni-Sn ternary systems and liquid Ni-P binary system are implemented. The description for FCC Cu-Al-Ni is updated.

MOBCU2 TO MOBCU3

Software release version: 2019b (June 2019)

This database is compatible with TCS Cu-based Alloys Database (TCCU3) and the update from MOBCU2 to MOBCU3 now contains data for the diffusion of the new element Ge in both FCC and liquid phases of Cu alloys.

MOBCU1 to MOBCU2

Software release version: 2017a (March 2017)

Two elements, Mo and O, are added in MOBCU2. The self-diffusion and related impurity diffusion data for Mo and O were included in both FCC_A1 and LIQUID phases. The complete and critical assessments for LIQUID Ag-Sn, Al-Ni, Al-Zn, Cu-Sn, Fe-Mn, Fe-Si and Pb-Sn binary systems are implemented. The description for LIQUID Ag-Cu has been updated.
