



Database name: TCS Ni-based Superalloys Database
Database acronym: TCNI5 **Database version:** 5.0
Database owner: Thermo-Calc Software AB
Database segment: Nickel Based Superalloys

Brief description

TCNI5 contains all the important Ni-based superalloy phases within a 20-element framework + Ar, H and O for the gas phase only. The ordered and disordered bcc (A2 and B2) and fcc (A1 and L12/ γ') have been modelled with a two sub-lattice model using a single Gibbs energy curve. TCNI5 can be used also with other software from Thermo-Calc Software such as the TC-Programming Interfaces and DICTRA.

Applications

Ni-based superalloys design and engineering.

Included Elements (23)

Al	Ar	B	C	Co	Cr	Fe	H	Hf	Mo	N	Nb
Ni	O	Pd	Pt	Re	Si	Ta	Ti	V	W	Zr	

Included Phases (most important phases for superalloys)

ALN_B4	FCC_L12#2 (γ')	M2B_TETR	NI3TA_D0A (Delta)
BCC_B2#1 (disordered BCC)	FCC_L12#3 (carbonitride)	M3B2	NI3TI_D024 (Eta)
BCC_B2#2 (ordered BCC)	FE4N_LP1	M3C2	P_PHASE
BCT_D022 (γ'')	FECN_CHI	M6C	PI
BETA_RHOMBO_B	G_PHASE	M7C3	R_PHASE
C14_LAVES	GAS	MB_B33	SIGMA
CEMENTITE	GRAPHITE	MB2_C32	TAU
CHI_A12	HCP_A3 (M2(C,N))	MC_ETA	Z_PHASE
D5A_M3B2	LIQUID	MC_SHP	
DIAMOND_A4	M12C	MU_PHASE	
FCC_L12#1 (Austenite/gamma)	M23C6	NI3B_D011	

Only the phases of interest for superalloys are defined by default. The complete description for most of the binary and many ternary systems is available using the BINARY and TERNARY modules (or by manually defining the missing phases before reading data from the database). **In total there are 292 different solution phases and intermetallic compounds.** Note that there are several possible composition sets for the phases named FCC_L12 and BCC_B2. They are either disordered (A1/carbonitride and A2) or ordered (L12 and B2). TCNI5 includes data for molar volumes enabling the calculation of density and lattice parameters (for cubic structures), coefficients of thermal expansion and/or relative length change.

Assessed Systems

Most of the binary systems in this database have been assessed and can be calculated with the BINARY Module in Thermo-Calc. TCNI5 also contains many assessed ternary systems, at least those being in equilibrium with gamma or gamma prime phase, and can be calculated with the TERNARY Module in Thermo-Calc. Note that argon, Ar, hydrogen, H, and oxygen, O, are modelled to take part in the gas phase only, and there is no solid solubility or condensed phase compounds with these phases included in the TCNI5 database.

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>