

## TCCC1: TCS Cemented Carbide Database

*Database name:* TCS Cemented Carbide Database *Database acronym:* TCCC

*Database owner:* Thermo-Calc Software AB *Database version:* 1.0

TCCC1: Cemented carbide -alloys database for Thermo-Calc. TCCC can also be used with the Software Development Kits (SDKs) and the add-on Diffusion Module (DICTRA) and/or Precipitation Module (TC-PRISMA).

This database is used in applications such as cemented carbide-alloy design and processing, including heat treatment. TCCC1 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. However, the molar volume data incorporated has no pressure dependence. It can be used with satisfactory results for cemented carbides with cobalt, iron and/or nickel binder.

### Included Elements (13)

C Co Cr Fe Mo N Nb Ni Ta Ti V W Zr

### Included Phases

GAS	LIQUID	BCC_A2	CEMENTITE
CHI_A12	CO3VV	D019_CO3MO	DIAMOND_FCC_A4
FCC_A1	FE4N_LP1	FECN_CHI	GRAPHITE
G_PHASE	HCP_A3	KSI_CARBIDE	LAVES_PHASE_C14
M12C	M23C6	M3C2	M5C2
M6C	M7C3	MC_ETA	MC_SHP
MU_PHASE	NBNi3	NI3TI	NITI2
PI	P_PHASE	R_PHASE	SIGMA
TAN_EPS	TI2N	Z_PHASE	

### Assessed Systems

TCCC1: Cemented carbide alloys database from Thermo-Calc Software covers the complete and critical assessments of many important binary and ternary systems, as well as some critical higher order systems, within the 13-element framework.

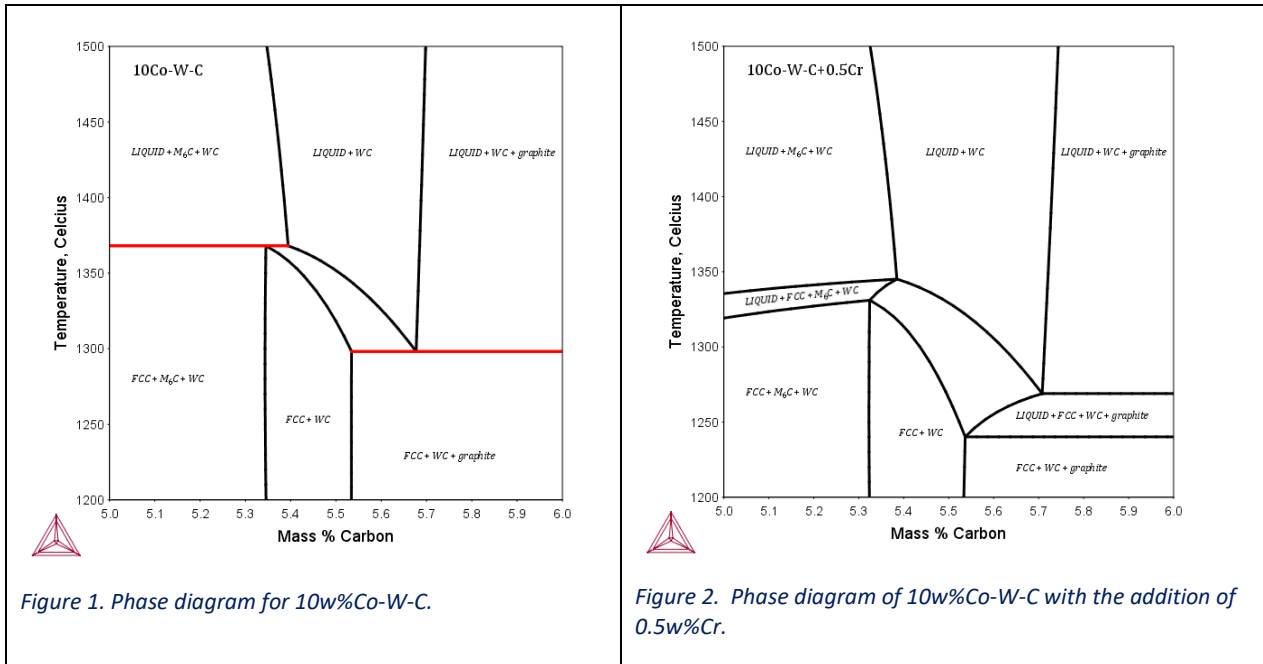


Table 1. Predicted invariant temperatures of solid/liquid equilibria including WC, (cubic carbide), and graphite or M<sub>6</sub>C compared with experimental data (see References).

System	Invariant temperature graphite, °C		Invariant temperature M <sub>6</sub> C, °C	
	Experimental	Calculated	Experimental	Calculated
Co-W-C	1298	1298	1368	1368
+Nb	1282	1287	1345	1349
+Ta	1289	1288	1352	1348
+Ti	1289	1292	1361	1363
+Zr	1283	1291	1358	1362

## References

[2001, Kruse] O. Kruse, B. Jansson, and K. Frisk, "Experimental Study of Invariant Equilibria in the Co-W-C and Co-W-C-Me (Me = Ti, Ta, Nb) Systems," J. Ph. Equilib., vol. 22(5), pp. 552–555, 2001.

[2006, Bratberg] J. Bratberg and B. Jansson, "Thermodynamic evaluation of the C-Co-W-Hf-Zr system for cemented carbides applications," J. Phase Equilib. Diff., vol. 27 (3), pp. 213–219, 2006.

## Scientific Models and References

See the Thermo-Calc Software reference list and reference library at: <http://www.thermocalc.com/resources/>