TCFE9: TCS Steel and Fe-alloys Database

Database name:	TCS Steel and Fe-alloys Database	*Database acronym:*	TCFE
Database owner:	Thermo-Calc Software AB	*Database version:*	9.0

TCFE is a thermodynamic database for calculation of phase diagrams and thermodynamic properties in steel and Fe-alloys. TCFE can be used with Thermo-Calc, its add-on simulation modules for diffusion (DICTRA) and precipitation (TC-PRISMA), and the Software Development Kits (SDK).

Applications include steel and Fe-alloy design and processing, including heat treatment. TCFE includes data for molar volumes enabling the calculation of density, lattice parameters (for cubic structures), coefficients of thermal expansion, and relative length change. However, the incorporated molar volume data (except for pure iron) has no pressure dependence. It can be used with satisfactory results for a range of different alloy types: e.g. stainless steels, high-speed steels, tool steels, HSLA steels, cemented carbides, cast iron, corrosion-resistant high strength steels and more.

Included Elements (28)

Ar	Al	B	C	Ca	Ce	Co	Cr	Cu	Fe	H	Mg	Mn	Mo
N	Nb	Ni	O	P	S	Si	Ta	Ti	V	W	Y	Zn	Zr

Assessed Systems

TCFE covers the complete and critical assessments of many important binary and ternary systems, as well as the iron-rich corner of some higher order systems, within the 28-element framework. Note that Ar and H are modelled to take part in the gas phase only, and no modelling of their solubility in the solid solution phases or liquid has been considered in the TCFE database.

Limits

The database is applicable for various types of steels/Fe-alloys with a Fe-minimum of 50wt%, and for alloying elements the recommended composition limits (in weight percent) are as follows:

Element	Max	Element	Max	Element	Max	Element	Max
Al	10	Cu	5	O	trace	W	15
B	trace	Mg	trace	P	trace	Y	*
C	7	Mn	30	S	trace	Zn	**
Ca	trace	Mo	10	Si	5	Zr	10
Ce	trace	N	5	Ta	10.0		
Co	20	Nb	5	Ti	3.0		
Cr	30	Ni	20	V	15.0		

* The element Zn has been added with the focus on the Zn corner of Al-Cr-Fe-Zn system for galvanization process, but several other binaries and ternaries are also included.

** The element Y has been added mainly for the purpose of oxide dispersion strengthened steels and the Al-Cr-Cu-Fe-Mn-Ni-O-Si-Y-Zr has been included which contains many assessed oxygen containing binary and ternary systems.

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 in knowing about any significant deviations in order to improve future versions of the database.