TTMG5: ThermoTech Mg-based Alloys Database

Database name:	ThermoTech Mg-based Alloys Database	*Database acronym:*	TTMG
Database owner:	ThermoTech	*Database version:*	5.1

TTMG5 is a comprehensive database for Mg-alloys that can be used for all major types of commercial Mg-alloys ranging from pure Mg to complex commercial alloys. TTMG5 can be used with Thermo-Calc, the add-on Diffusion Module (DICTRA) and/or Precipitation Module (TC-PRISMA), and the TC-PI programming-interfaces.

Included Elements (17)

Al Ca Ce Cu Fe Gd La Mg Mn Nd Sc Si Sn Sr Y Zn Zr

Included Phases

Note that the FCC_A1, DHCP, DIAMOND_A4, BCT_A5 and Alpha_Zr are always rejected by default; while, if it is necessary for some systems with higher-contents of Fe/La/Nd/Si/Sn/Zr, they can be restored in the TDB Module. The nomenclature surrounding the various intermetallic phases can differ depending on which reference text is used as a basis.

Liquid	HCP_A3 (Mg-dominant)			
Mg17Al12	Mg2Ca	Mg2Cu	MgCu2	Mg5Gd
Mg3RE_D03	Mg12RE	Mg41RE5	Mg2Si	Mg2Sn
Mg17Sr2	Mg24Y5	MgZn	MgZn2	Mg2Zn3
Phi-AlMgZn	Q-Al7Cu3Mg6	T-AlCuMgZn	T-MgCeZn	
I-MgYZn	W-MgYZn	X-MgYZn	Z-MgYZn	
A12Fe	A13Fe	A15Fe2	Al4(Ca,Sr)	Ca2Sn
A14Mn	A18Mn5	Al11Mn4	A12Zr	A13Zr
Al2RE	Al3RE_D019	Al11RE3_alpha	Ca2Mg5Zn13	Ca2Mg6Zn3
Alpha_Zr (Zr-rich HCP_A3)	BCC_A2 (pure-Fe_alpha)	CBCC_A12 (pure-Mn_alpha)	CUB_A3 (pure-Mn_beta)	
FCC_A1 (pure-Al,Ca,Ce,Cu,Sr and pure-La_beta)	DHCP (pure-La/Nd)	DIAMOND_A4 (pure-Si)	BCT_A5 (pure-Sn)	

Assessed Systems

All phases have been critically assessed and treated by some appropriate thermodynamic models (*e.g.* the Sublattice Model for solid solutions and liquid mixture phases), which are applicable to various grades of multicomponent Mg-alloys over a wide temperature-pressure-composition range. The Liquid and HCP-A3 phases are modeled as substitutional mixing phases, with the HCP-A3 phase corresponding to the Mg-rich solid solution. From TTMg4 to TTMg5, Sn-bearing phases Mg2Sn and Ca2Sn have been added. New assessments of the Mg-Zn-(Ca,Ce,Y) ternaries are included, which means inclusion of new ternary phases as listed. Also certain Al-rich phases (Al6Mn, AlMSi_alpha, Al8FeMg3Si6 and Al5Cu2Mg8Si6) have been removed as they would never be formed in Mg-alloys.

Validations

TTMG is a sister database to TTAl and helps provides new insight into phase equilibria behaviour in complex Mg-alloys. Like TTAl it is well suited for use in the modelling of non-equilibrium solidification processes. As part of a validation process of the database, extensive comparison has been made between the simulated results and available experimental data for Mg-alloys. The database performs at accuracy close to the level expected of the experiments.

The database can be used for predictions of all types of equilibria, solvus, solidus and liquidus relations, etc. Using the SCHEIL module in the Thermo-Calc software, it is also possible to make solidification simulations which provide effective predictions for non-equilibrium micro-segregation, f_s vs T plots, heat evolution, etc, of multicomponent Mg-alloys in conditions that are well away from those associated with equilibrium. For more complex modeling, the calculations provide critical information which otherwise can only be found by the use of expensive experimental techniques.

Limits

As in the spirit of the CALPHAD method, combinations of several critically-assessed systems can calculate and extrapolate higher-order multicomponent systems; such extrapolations require experience and understanding and the producer or vendor should be contacted if problems occur. 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. The TTMG database has been developed primarily for performing various types of calculations of multicomponent Mg-based alloys; but please also note that it is not aimed at calculating complete binary/ternary/quaternary phase diagrams.