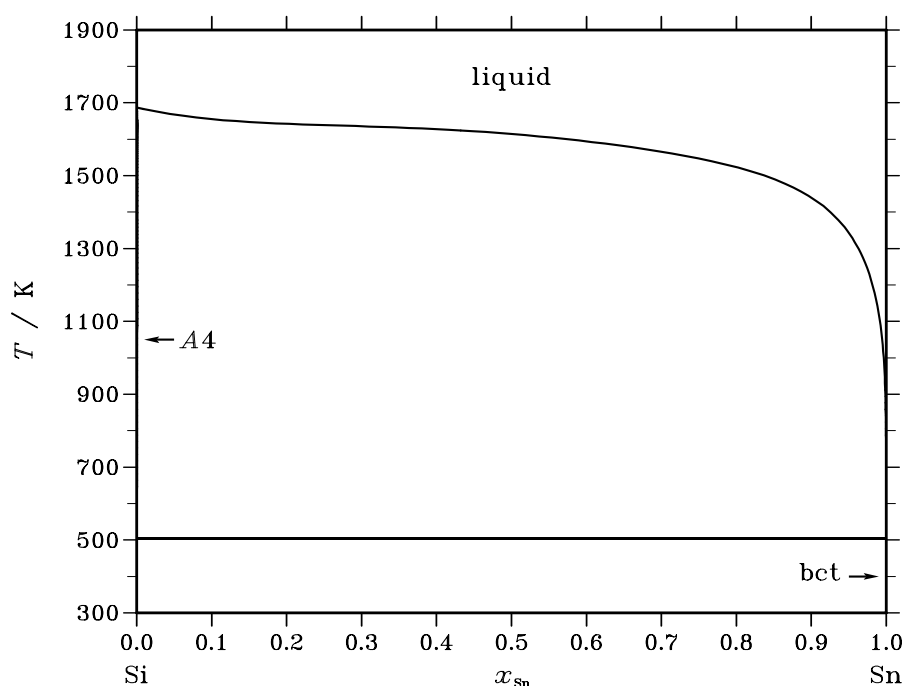


Si – Sn (Silicon – Tin)**Fig. 1.** Calculated phase diagram for the system Si-Sn.

The Si-Sn system is characterised by complete mixing of the components in the liquid phase and low solubility in both the diamond form of Si and the bct form of Sn. The shape of the liquidus surface indicates positive enthalpies of mixing and the likelihood of a metastable miscibility gap. While this system seems to have no particular technological importance in its own right, an understanding of the phase diagram and thermodynamic properties are essential in order to model important ternary systems such as the Al-Si-Sn system, key to certain types of aluminium alloys used by industry.

The critically assessed data adopted by SGTE for this system are from the work of Jacobs and Spencer [96Jac]. They are based entirely on the few measurements of the liquidus surface and single measurement of the solubility of Sn in diamond Si. The agreement between experiment and calculation is good. The experimental data for the system had previously been reviewed by Olesinski and Abbaschian [84Ole].

Table I. Phases, structures and models.

Phase	Strukturbericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	(Si,Sn) ₁
A4	A4	C(diamond)	<i>cF8</i>	<i>Fd$\bar{3}m$</i>	DIAMOND_A4	(Si,Sn) ₁
bct	A5	β Sn	<i>tI4</i>	<i>I4₁/amd</i>	BCT_A5	Sn ₁

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Sn}			$\Delta_r H / (J/mol)$
liquid \rightleftharpoons A4 + bct	eutectic	505.1	1.000	0.000	1.000	-7029

Table IIIa. Integral quantities for the liquid phase at 1800 K.

x_{Sn}	ΔG_{m} [J/mol]	ΔH_{m} [J/mol]	ΔS_{m} [J/(mol·K)]	G_{m}^{E} [J/mol]	S_{m}^{E} [J/(mol·K)]	ΔC_P [J/(mol·K)]
0.000	0	0	0.000	0	0.000	0.000
0.100	−2099	2766	2.703	2766	0.000	0.000
0.200	−2872	4618	4.161	4618	0.000	0.000
0.300	−3401	5741	5.079	5741	0.000	0.000
0.400	−3791	6281	5.596	6281	0.000	0.000
0.500	−4033	6341	5.763	6341	0.000	0.000
0.600	−4093	5979	5.596	5979	0.000	0.000
0.700	−3930	5212	5.079	5212	0.000	0.000
0.800	−3476	4013	4.161	4013	0.000	0.000
0.900	−2552	2313	2.703	2313	0.000	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: Si(liquid), Sn(liquid)

Table IIIb. Partial quantities for Si in the liquid phase at 1800 K.

x_{Si}	ΔG_{Si} [J/mol]	ΔH_{Si} [J/mol]	ΔS_{Si} [J/(mol·K)]	G_{Si}^{E} [J/mol]	S_{Si}^{E} [J/(mol·K)]	a_{Si}	γ_{Si}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−1084	493	0.876	493	0.000	0.930	1.033
0.800	−1641	1699	1.855	1699	0.000	0.896	1.120
0.700	−2031	3307	2.966	3307	0.000	0.873	1.247
0.600	−2510	5135	4.247	5135	0.000	0.846	1.409
0.500	−3245	7128	5.763	7128	0.000	0.805	1.610
0.400	−4352	9362	7.619	9362	0.000	0.748	1.869
0.300	−5981	12038	10.010	12038	0.000	0.671	2.235
0.200	−8599	15488	13.382	15488	0.000	0.563	2.815
0.100	−14290	20171	19.145	20171	0.000	0.385	3.849
0.000	−∞	26677	∞	26677	0.000	0.000	5.945

Reference state: Si(liquid)

Table IIIc. Partial quantities for Sn in the liquid phase at 1800 K.

x_{Sn}	ΔG_{Sn} [J/mol]	ΔH_{Sn} [J/mol]	ΔS_{Sn} [J/(mol·K)]	G_{Sn}^{E} [J/mol]	S_{Sn}^{E} [J/(mol·K)]	a_{Sn}	γ_{Sn}
0.000	−∞	32974	∞	32974	0.000	0.000	9.055
0.100	−11229	23232	19.145	23232	0.000	0.472	4.722
0.200	−7793	16294	13.382	16294	0.000	0.594	2.970
0.300	−6598	11421	10.010	11421	0.000	0.643	2.145
0.400	−5712	8001	7.619	8001	0.000	0.683	1.707
0.500	−4820	5554	5.763	5554	0.000	0.725	1.449
0.600	−3921	3724	4.247	3724	0.000	0.770	1.283
0.700	−3051	2287	2.966	2287	0.000	0.816	1.165
0.800	−2195	1144	1.855	1144	0.000	0.864	1.079
0.900	−1248	329	0.876	329	0.000	0.920	1.022
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Sn(liquid)

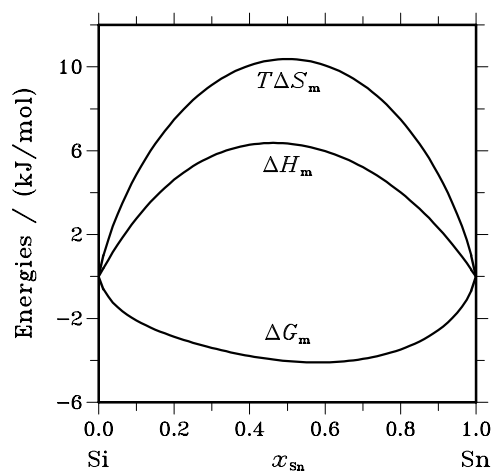


Fig. 2. Integral quantities of the liquid phase at $T=1800$ K.

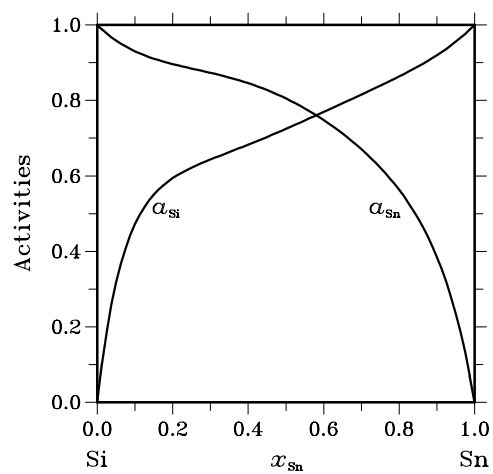


Fig. 3. Activities in the liquid phase at $T=1800$ K.

References

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 [96Jac] M.H.G. Jacobs, P.J. Spencer: Calphad **20** (1996) 89–91.