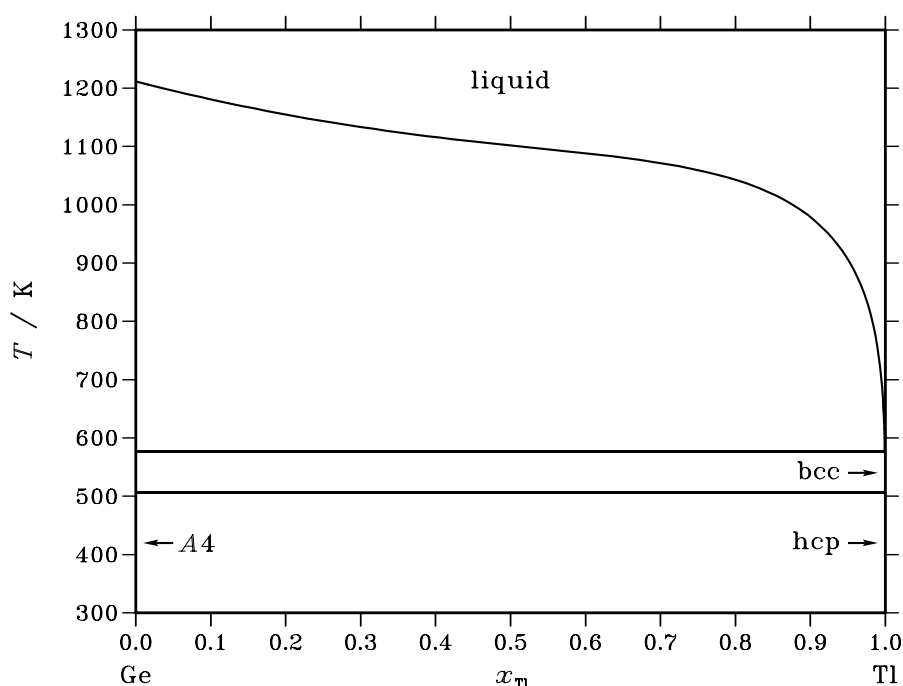


Ge – Tl (Germanium – Thallium)**Fig. 1.** Calculated phase diagram for the system Ge-Tl.

A thermodynamic assessment of the Ge-Tl system has been given by Chevalier [89Che] and it was later revised [03Che]. The phase diagram is rather simple and of eutectic type, deported on the Tl rich side, with a complete mutual solubility in the liquid, a retrograde small solubility of Tl in crystalline Ge [62Koz, 62Tag], and an unknown but negligible solubility of Ge in hcp-Tl and bcc-Tl. There are no compounds in the system and the solution phases were modelled as simple substitutional solutions. The liquidus has been experimentally determined by [48Kle, 58Sav, 60Thu], and the enthalpy of mixing of liquid alloys has been measured by direct high temperature calorimetry by [71Pre]. Further experimental work would be necessary to assess the variation of activity with temperature, which is important for extrapolation of data at high temperatures.

Table I. Phases, structures and models.

Phase	Strukturbericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	(Ge,Tl) ₁
A4	A4	C(diamond)	<i>cF</i> 8	<i>Fd</i> $\bar{3}m$	DIAMOND_A4	(Ge,Tl) ₁
bcc	A2	W	<i>cI</i> 2	<i>Im</i> $\bar{3}m$	BCC_A2	(Ge,Tl) ₁
hcp	A3	Mg	<i>hP</i> 2	<i>P</i> 6 ₃ / <i>mmc</i>	HCP_A3	(Ge,Tl) ₁

Table II. Invariant reactions.

Reaction	Type	<i>T</i> / K	Compositions / <i>x</i> _{Tl}			$\Delta_r H$ / (J/mol)
liquid \rightleftharpoons A4 + bcc	eutectic	576.5	0.999	0.000	1.000	−4179
bcc \rightleftharpoons A4 + hcp	degenerate	507.0	1.000	0.000	1.000	−360

Table IIIa. Integral quantities for the liquid phase at 1273 K.

x_{Tl}	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	−2341	1143	2.737	1099	0.034	0.000
0.200	−3296	2078	4.221	2001	0.060	0.000
0.300	−3779	2788	5.158	2687	0.079	0.000
0.400	−3984	3255	5.686	3140	0.091	0.000
0.500	−3994	3463	5.858	3343	0.095	0.000
0.600	−3845	3394	5.686	3279	0.091	0.000
0.700	−3536	3031	5.158	2929	0.079	0.000
0.800	−3018	2355	4.221	2278	0.060	0.000
0.900	−2133	1351	2.737	1308	0.034	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: Ge(liquid), Tl(liquid)

Table IIIb. Partial quantities for Ge in the liquid phase at 1273 K.

x_{Ge}	ΔG_{Ge} [J/mol]	ΔH_{Ge} [J/mol]	ΔS_{Ge} [J/(mol·K)]	G_{Ge}^{E} [J/mol]	S_{Ge}^{E} [J/(mol·K)]	a_{Ge}	γ_{Ge}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−1019	101	0.880	96	0.004	0.908	1.009
0.800	−1954	427	1.870	408	0.015	0.831	1.039
0.700	−2806	1013	3.000	969	0.034	0.767	1.096
0.600	−3591	1893	4.308	1816	0.060	0.712	1.187
0.500	−4355	3102	5.858	2981	0.095	0.663	1.325
0.400	−5197	4675	7.755	4501	0.136	0.612	1.530
0.300	−6333	6646	10.196	6410	0.185	0.550	1.832
0.200	−8292	9051	13.624	8743	0.242	0.457	2.284
0.100	−12838	11923	19.451	11534	0.306	0.297	2.973
0.000	−∞	15299	∞	14817	0.378	0.000	4.055

Reference state: Ge(liquid)

Table IIIc. Partial quantities for Tl in the liquid phase at 1273 K.

x_{Tl}	ΔG_{Tl} [J/mol]	ΔH_{Tl} [J/mol]	ΔS_{Tl} [J/(mol·K)]	G_{Tl}^{E} [J/mol]	S_{Tl}^{E} [J/(mol·K)]	a_{Tl}	γ_{Tl}
0.000	−∞	12407	∞	11926	0.378	0.000	3.086
0.100	−14243	10518	19.451	10128	0.306	0.260	2.604
0.200	−8662	8681	13.624	8373	0.242	0.441	2.206
0.300	−6050	6930	10.196	6694	0.185	0.565	1.882
0.400	−4572	5299	7.755	5126	0.136	0.649	1.623
0.500	−3632	3825	5.858	3704	0.095	0.710	1.419
0.600	−2943	2540	4.308	2463	0.060	0.757	1.262
0.700	−2338	1481	3.000	1438	0.034	0.802	1.145
0.800	−1700	681	1.870	662	0.015	0.852	1.065
0.900	−944	176	0.880	171	0.004	0.915	1.016
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Tl(liquid)

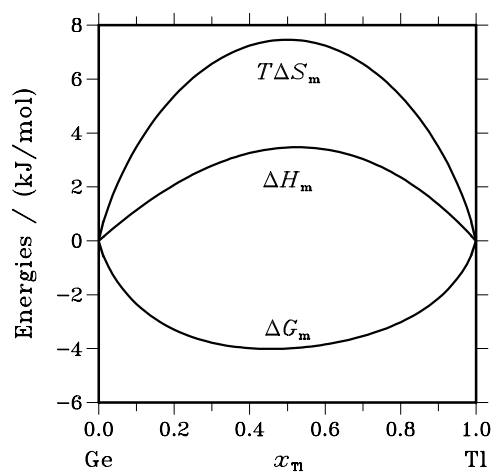


Fig. 2. Integral quantities of the liquid phase at $T=1273$ K.

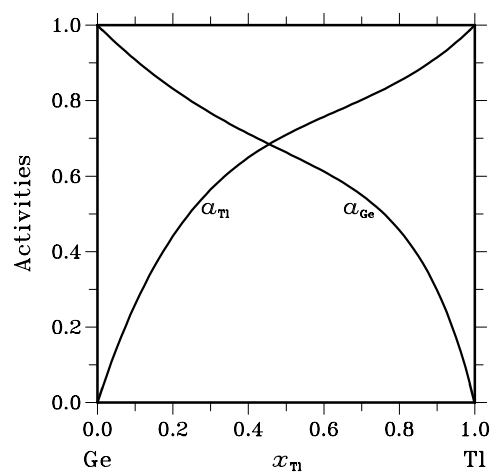


Fig. 3. Activities in the liquid phase at $T=1273$ K.

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