Au – B (Gold – Boron)

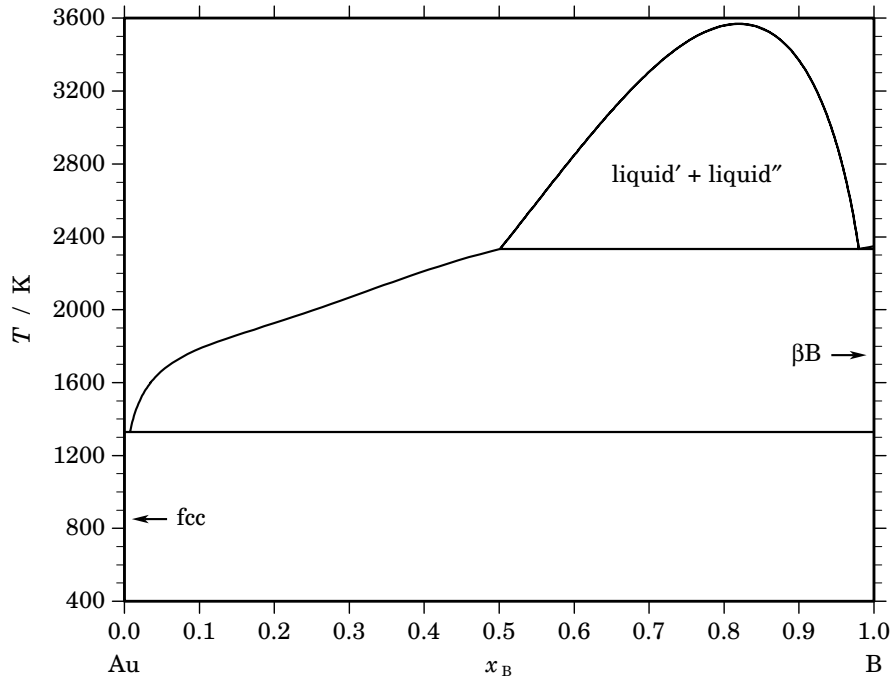

Fig. 1. Calculated phase diagram for the system Au-B.

The Au-B binary system was assessed by Chevalier [1998Che]. The phase diagram reported in the compilation of Moffatt [1981Mof] is based on the investigations of Wald and Stormont [1965Wal] using X-ray analysis, optical metallography, and thermal analysis. The compound AuB_2 previously reported by Elliott [1965Ell] could not be confirmed. An eutectic reaction deported on the gold side, was determined at 1329 K and less than 5 at.% B. A liquid miscibility gap is believed to exist at compositions of more than 50 at.% B, with a monotectic reaction at about 15 K below the melting point of boron, which has been given at 2498 K [1981Mof]. However, in the optimisation [1998Che] the recommended melting temperature for boron of 2348 K [91Din] has been used and consequently the calculated monotectic temperature is located 15 K lower at 2333 K. No mutual solubility of both elements is known in the solid state and no thermodynamic properties are available for that system.

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(Au,B)_1$
fcc	$A1$	Cu	$cF4$	$Fm\overline{3}m$	FCC_A1	$Au_1(B,\Box)_1$
βB	$\cdots$	βB	$hR105$	$R\overline{3}m$	BETA_RHOMBO_B	$B_{93}B_{12}$

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_B			$\Delta_r H$ / (J/mol)
liquid $\rightleftharpoons$ liquid′ + liquid″	critical	3560.0	0.819	0.819	0.819	0
liquid″ $\rightleftharpoons$ liquid′ + βB	monotectic	2333.0	0.501	0.980	1.000	−49219
liquid′ $\rightleftharpoons$ fcc + βB	eutectic	1328.8	0.000	0.008	1.000	−13079

Table IIIa. Integral quantities for the liquid phase at 2000 K.

x_{B}	ΔG_{m} [J/mol]	ΔH_{m} [J/mol]	ΔS_{m} [J/(mol·K)]	$G_{\mathrm{m}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{m}}^{\mathrm{E}}$ [J/(mol·K)]	ΔC_P [J/(mol·K)]
0.000	0	0	0.000	0	0.000	0.000
0.100	−1953	7689	4.821	3453	2.118	0.149
0.200	−2312	14483	8.397	6009	4.237	0.297
0.253	−2239	17903	10.071	7172	5.366	0.376

Reference states: Au(liquid), B(βB)

Table IIIb. Partial quantities for Au in the liquid phase at 2000 K.

x_{Au}	ΔG_{Au} [J/mol]	ΔH_{Au} [J/mol]	ΔS_{Au} [J/(mol·K)]	$G_{\mathrm{Au}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Au}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Au}	γ_{Au}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−1212	541	0.876	541	0.000	0.930	1.033
0.800	−2256	1455	1.855	1455	0.000	0.873	1.091
0.747	−2999	1858	2.429	1858	0.000	0.835	1.118

Reference state: Au(liquid)

Table IIIc. Partial quantities for B in the liquid phase at 2000 K.

x_{B}	ΔG_{B} [J/mol]	ΔH_{B} [J/mol]	ΔS_{B} [J/(mol·K)]	$G_{\mathrm{B}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{B}}^{\mathrm{E}}$ [J/(mol·K)]	a_{B}	γ_{B}
0.000	$-\infty$	83388	∞	41022	21.183	0.000	11.786
0.100	−8628	72028	40.328	29662	21.183	0.595	5.952
0.200	−2535	66595	34.565	24228	21.183	0.859	4.293
0.253	0	65201	32.600	22834	21.183	1.000	3.948

Reference state: B(βB)

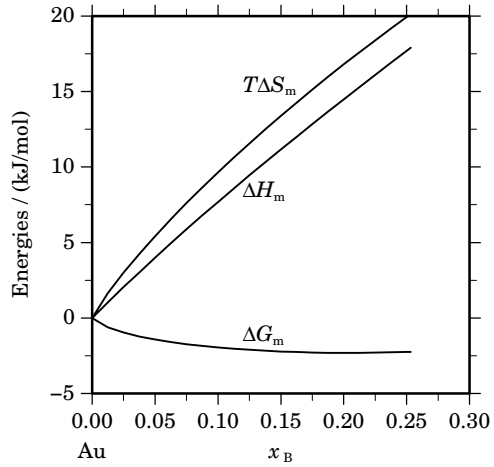

Fig. 2. Integral quantities of the liquid phase at T=2000 K.

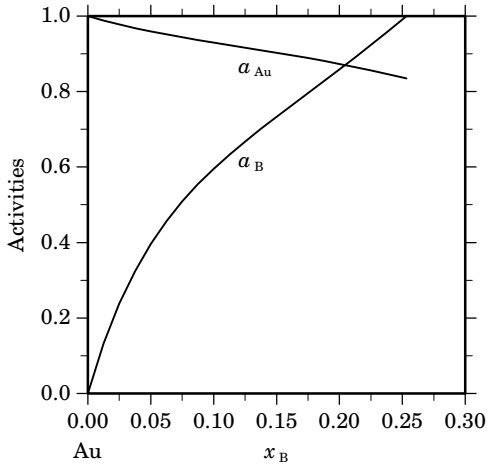

Fig. 3. Activities in the liquid phase at T=2000 K.

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