Al – Be (Aluminium – Beryllium)

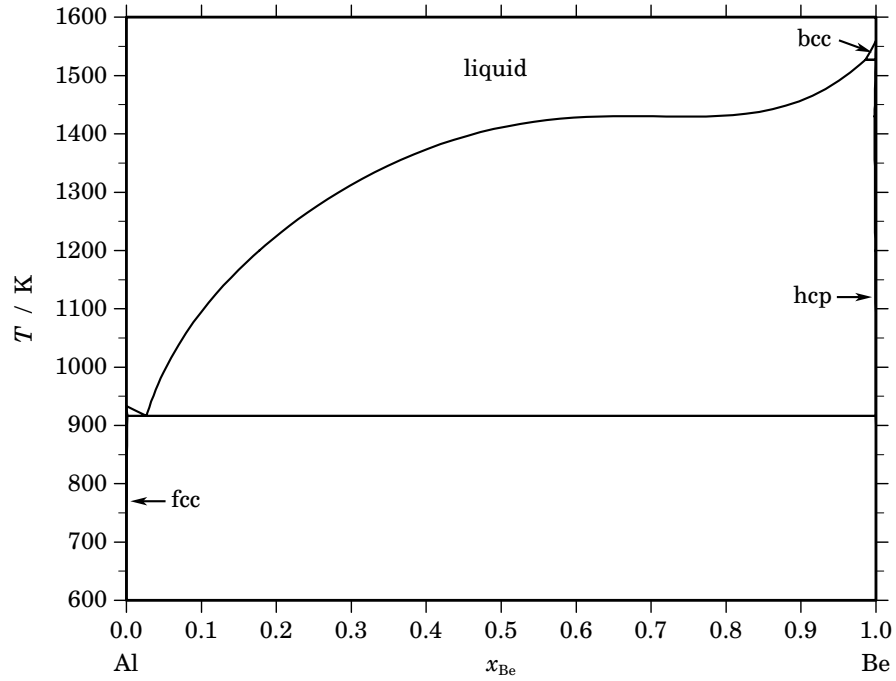

Fig. 1. Calculated phase diagram for the system Al-Be.

The Al–Be system has been reviewed in [1987Mur, 2004Pan] and a thermodynamic assessment has been given in [2004Pan]. The phase diagram shows a simple eutectic with the melting minimum close to the Al-side and with only small mutual solid solubility of the elements. The thermodynamic optimisation is based on experimental data from the literature as well as on new experiments reported in [2004Pan]. Data for the liquidus and for the solubility of beryllium in aluminium from several investigations are taken into account. In addition, activity data for the elements in the liquid have been included in the assessment.

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(Al,Be)_1$
fcc	$A1$	Cu	$cF4$	$Fm\overline{3}m$	FCC_A1	$(Al,Be)_1$
bcc	$A2$	W	$cI2$	$Im\overline{3}m$	BCC_A2	$(Al,Be)_1$
hcp	$A3$	Mg	$hP2$	$P6_3/mmc$	HCP_A3	$(Al,Be)_1$

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Be}			$\Delta_r H$ / (J/mol)
liquid + bcc $\rightleftharpoons$ hcp	peritectic	1527.0	0.986	1.000	1.000	−6848
liquid $\rightleftharpoons$ fcc + hcp	eutectic	916.5	0.027	0.001	1.000	−12033

Table IIIa. Integral quantities for the liquid phase at 1600 K.

x_{Be}	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	−3942	4415	5.223	383	2.520	0.000
0.200	−5661	8164	8.641	996	4.480	0.000
0.300	−6405	11129	10.959	1721	5.880	0.000
0.400	−6513	13192	12.316	2440	6.720	0.000
0.500	−6186	14235	12.763	3035	7.000	0.000
0.600	−5567	14138	12.316	3386	6.720	0.000
0.700	−4749	12785	10.959	3377	5.880	0.000
0.800	−3769	10056	8.641	2888	4.480	0.000
0.900	−2523	5834	5.223	1802	2.520	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: Al(liquid), Be(liquid)

Table IIIb. Partial quantities for Al in the liquid phase at 1600 K.

x_{Al}	ΔG_{Al} [J/mol]	ΔH_{Al} [J/mol]	ΔS_{Al} [J/(mol·K)]	$G_{\mathrm{Al}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Al}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Al}	γ_{Al}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−1537	313	1.156	−135	0.280	0.891	0.990
0.800	−3350	1410	2.975	−382	1.120	0.777	0.972
0.700	−5249	3528	5.486	−504	2.520	0.674	0.963
0.600	−7061	6903	8.727	−266	4.480	0.588	0.980
0.500	−8650	11771	12.763	571	7.000	0.522	1.044
0.400	−9948	18369	17.698	2241	10.080	0.473	1.183
0.300	−11035	26934	23.730	4982	13.720	0.436	1.454
0.200	−12380	37703	31.302	9031	17.920	0.394	1.972
0.100	−16009	50911	41.825	14623	22.680	0.300	3.002
0.000	$-\infty$	66795	∞	21995	28.000	0.000	5.225

Reference state: Al(liquid)

Table IIIc. Partial quantities for Be in the liquid phase at 1600 K.

x_{Be}	ΔG_{Be} [J/mol]	ΔH_{Be} [J/mol]	ΔS_{Be} [J/(mol·K)]	$G_{\mathrm{Be}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Be}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Be}	γ_{Be}
0.000	$-\infty$	47083	∞	2283	28.000	0.000	1.187
0.100	−25589	41331	41.825	5043	22.680	0.146	1.461
0.200	−14903	35179	31.302	6507	17.920	0.326	1.631
0.300	−9103	28866	23.730	6914	13.720	0.504	1.682
0.400	−5691	22627	17.698	6499	10.080	0.652	1.630
0.500	−3722	16699	12.763	5499	7.000	0.756	1.512
0.600	−2646	11318	8.727	4150	4.480	0.820	1.366
0.700	−2056	6721	5.486	2689	2.520	0.857	1.224
0.800	−1616	3145	2.975	1353	1.120	0.886	1.107
0.900	−1024	826	1.156	378	0.280	0.926	1.029
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Be(liquid)

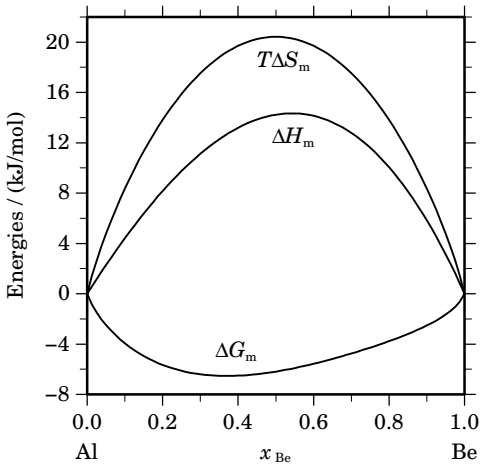

Fig. 2. Integral quantities of the liquid phase at T=1600 K.

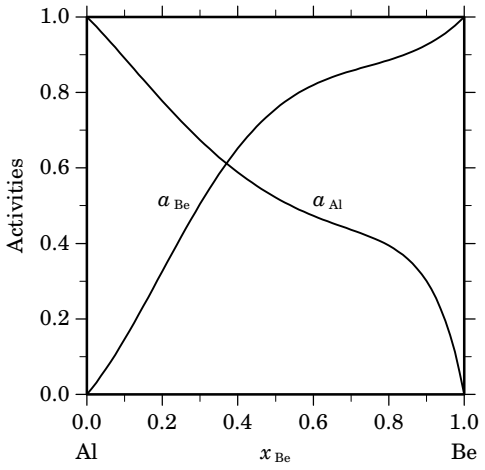

Fig. 3. Activities in the liquid phase at T=1600 K.

References

[1987Mur] J.L. Murray, D.J. Kahan in: "Phase Diagrams of Binary Beryllium Alloys", H. Okamoto, L.E. Tanner, Eds., ASM Int., Metals Park, OH, 1987, pp. 9–14.

[2004Pan] Z. Pan, Y. Du, B.Y. Huang, Y. Liu, R.C. Wang: Calphad **28** (2004) 371–378.