Li – Na (Lithium – Sodium)

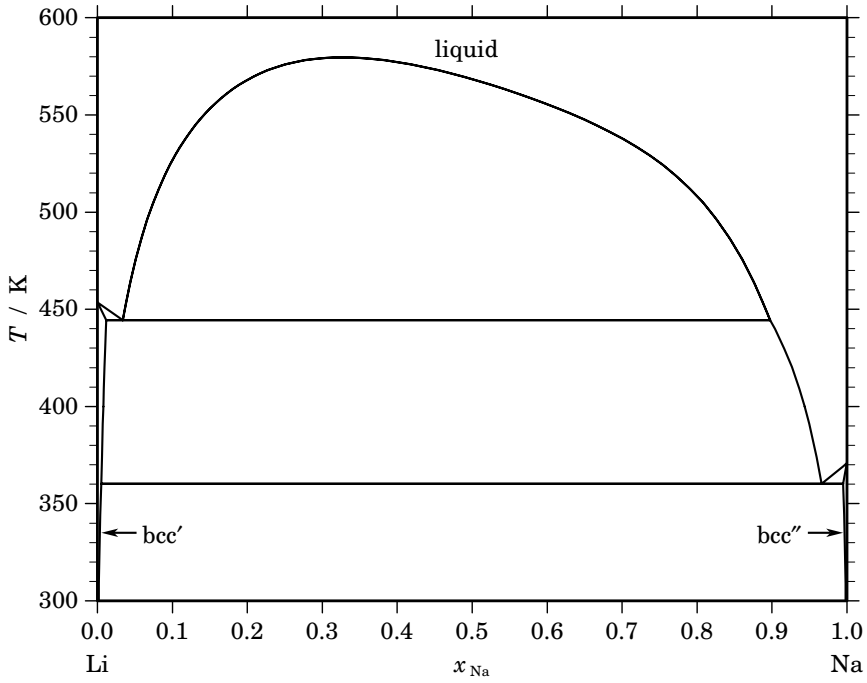

Fig. 1. Calculated phase diagram for the system Li-Na.

The literature on the Li-Na system has been reviewed by Bale [1989Bal] and a thermodynamic dataset has been optimised in [2003Zha] based on the element data recommended by SGTE. The system is characterised by dominant miscibility gaps in the liquid as well as in the solid (bcc) phase. For the optimisation Zhang *et al.* [2003Zha] have selected data for the phase equilibria from several experimental reports which are in general agreement with each other [1956Sal, 1957How, 1968Kan, 1971Sch, 1975Dow1, 1975Dow2, 1975Fei, 1975Wu, 1979End]. In most of these investigations the liquid-liquid equilibria have been determined. No data on the thermodynamics of mixing have been available.

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(Li,Na)_1$
bcc	$A2$	W	$cI2$	$Im\overline{3}m$	BCC_A2	$(Li,Na)_1$

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Na}			$\Delta_r H$ / (J/mol)
liquid $\rightleftharpoons$ liquid′ + liquid″	critical	579.6	0.327	0.327	0.327	0
liquid′ $\rightleftharpoons$ bcc′ + liquid″	monotectic	444.3	0.034	0.012	0.898	−3227
liquid″ $\rightleftharpoons$ bcc′ + bcc″	eutectic	360.3	0.966	0.005	0.995	−2796

Table IIIa. Integral quantities for the liquid phase at 600 K.

x_{Na}	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	−528	1333	3.102	1094	0.399	0.000
0.200	−641	2174	4.692	1855	0.532	0.000
0.300	−703	2624	5.544	2345	0.465	0.000
0.400	−751	2766	5.862	2607	0.266	0.000
0.500	−787	2671	5.763	2671	0.000	0.000
0.600	−806	2392	5.330	2552	−0.266	0.000
0.700	−799	1969	4.614	2249	−0.465	0.000
0.800	−751	1426	3.629	1745	−0.532	0.000
0.900	−610	772	2.304	1011	−0.399	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: Li(liquid), Na(liquid)

Table IIIb. Partial quantities for Li in the liquid phase at 600 K.

x_{Li}	ΔG_{Li} [J/mol]	ΔH_{Li} [J/mol]	ΔS_{Li} [J/(mol·K)]	$G_{\mathrm{Li}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Li}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Li}	γ_{Li}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−348	264	1.020	177	0.144	0.933	1.036
0.800	−491	914	2.343	622	0.487	0.906	1.133
0.700	−543	1775	3.863	1236	0.897	0.897	1.281
0.600	−579	2714	5.488	1969	1.241	0.890	1.484
0.500	−644	3645	7.148	2814	1.385	0.879	1.758
0.400	−760	4529	8.815	3811	1.196	0.859	2.147
0.300	−963	5369	10.553	5044	0.543	0.824	2.748
0.200	−1386	6218	12.673	6643	−0.709	0.757	3.787
0.100	−2702	7170	16.453	8785	−2.692	0.582	5.818
0.000	$-\infty$	8368	∞	11691	−5.539	0.000	10.418

Reference state: Li(liquid)

Table IIIc. Partial quantities for Na in the liquid phase at 600 K.

x_{Na}	ΔG_{Na} [J/mol]	ΔH_{Na} [J/mol]	ΔS_{Na} [J/(mol·K)]	$G_{\mathrm{Na}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Na}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Na}	γ_{Na}
0.000	$-\infty$	16160	∞	12837	5.539	0.000	13.107
0.100	−2145	10957	21.837	9342	2.692	0.651	6.505
0.200	−1239	7215	14.091	6790	0.709	0.780	3.900
0.300	−1075	4606	9.468	4931	−0.543	0.806	2.687
0.400	−1008	2845	6.422	3563	−1.196	0.817	2.043
0.500	−930	1697	4.378	2528	−1.385	0.830	1.660
0.600	−836	968	3.007	1713	−1.241	0.846	1.410
0.700	−729	512	2.068	1051	−0.897	0.864	1.234
0.800	−592	229	1.368	521	−0.487	0.888	1.110
0.900	−378	61	0.732	148	−0.144	0.927	1.030
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Na(liquid)

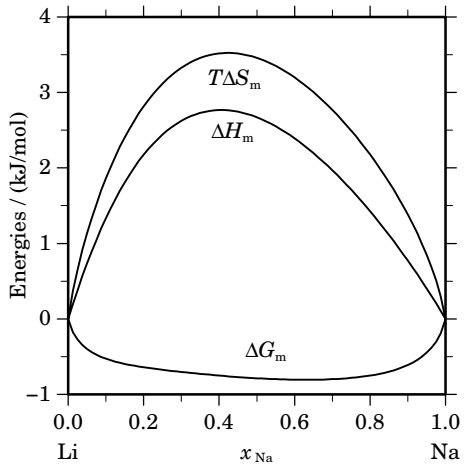

Fig. 2. Integral quantities of the liquid phase at T=600 K.

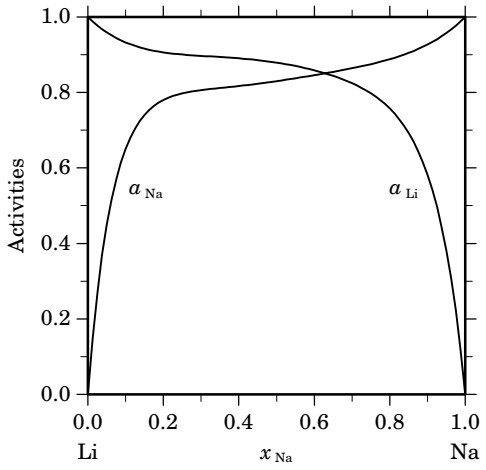

Fig. 3. Activities in the liquid phase at T=600 K.

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