Na – Rb (Sodium – Rubidium)

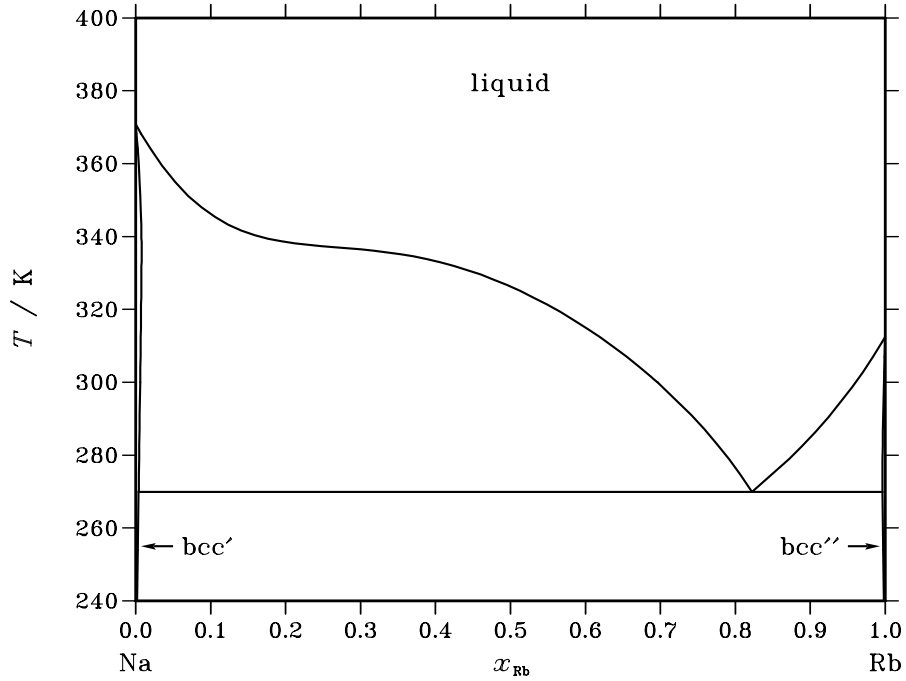

Fig. 1. Calculated phase diagram for the system Na-Rb.

The phase diagram for the Na-Rb system exhibits complete mixing between the pure elements in the liquid phase and small mutual solubility of the crystalline elements. The liquidus surface for Na rich compositions indicates a tendency to form a metastable miscibility gap in the liquid phase at lower temperatures. The eutectic temperature is at 268.6 K corresponding to a liquid composition of 82 at.% Rb. The dataset adopted by SGTE was derived by Potter and Rand [85Pot] and is in very good agreement with the experimental data for the system. The phase diagram has been studied by Goates *et al.* [70Goa], Goria [35Gor] and Rinck [33Rin]. Thermodynamic properties in the liquid phase were measured by Yokokawa and Kleppa [64Yok] with a reaction calorimeter and the assessment was based on these data coupled to the experimental phase diagram information. More recently vapour pressure measurements have been carried out by Kruszewski *et al.* [84Kru]. The system has also been reviewed by Bale [82Bal].

Table I. Phases, structures and models.

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

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Rb}			$\Delta_r H$ / (J/mol)
liquid $\rightleftharpoons$ bcc′ + bcc″	eutectic	269.9	0.822	0.004	0.996	−2742

Table IIIa. Integral quantities for the liquid phase at 384 K.

x_{Rb}	ΔG_{m} [J/mol]	ΔH_{m} [J/mol]	ΔS_{m} [J/(mol·K)]	$G^{\mathrm{E}}_{\mathrm{m}}$ [J/mol]	$S^{\mathrm{E}}_{\mathrm{m}}$ [J/(mol·K)]	ΔC_P [J/(mol·K)]
0.000	0	0	0.000	0	0.000	0.000
0.100	−449	594	2.717	589	0.014	0.000
0.200	−625	983	4.188	972	0.028	0.000
0.300	−755	1196	5.081	1196	0.002	0.000
0.400	−855	1262	5.513	1294	−0.083	0.000
0.500	−920	1208	5.542	1293	−0.222	0.000
0.600	−940	1060	5.208	1209	−0.387	0.000
0.700	−904	842	4.548	1046	−0.531	0.000
0.800	−796	578	3.579	801	−0.581	0.000
0.900	−577	291	2.260	461	−0.443	0.000
1.000	0	0	0.000	0	0.000	0.000

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

Table IIIb. Partial quantities for Na in the liquid phase at 384 K.

x_{Na}	ΔG_{Na} [J/mol]	ΔH_{Na} [J/mol]	ΔS_{Na} [J/(mol·K)]	$G^{\mathrm{E}}_{\mathrm{Na}}$ [J/mol]	$S^{\mathrm{E}}_{\mathrm{Na}}$ [J/(mol·K)]	a_{Na}	γ_{Na}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−225	108	0.867	111	−0.009	0.932	1.035
0.800	−333	391	1.885	379	0.030	0.901	1.126
0.700	−410	791	3.130	728	0.164	0.879	1.256
0.600	−518	1256	4.621	1113	0.374	0.850	1.417
0.500	−697	1735	6.334	1516	0.571	0.804	1.608
0.400	−974	2182	8.221	1951	0.602	0.737	1.842
0.300	−1383	2554	10.254	2461	0.244	0.648	2.161
0.200	−2021	2813	12.589	3118	−0.793	0.531	2.655
0.100	−3328	2923	16.279	4023	−2.866	0.353	3.526
0.000	$-\infty$	2852	∞	5310	−6.399	0.000	5.275

Reference state: Na(liquid)

Table IIIc. Partial quantities for Rb in the liquid phase at 384 K.

x_{Rb}	ΔG_{Rb} [J/mol]	ΔH_{Rb} [J/mol]	ΔS_{Rb} [J/(mol·K)]	$G^{\mathrm{E}}_{\mathrm{Rb}}$ [J/mol]	$S^{\mathrm{E}}_{\mathrm{Rb}}$ [J/(mol·K)]	a_{Rb}	γ_{Rb}
0.000	$-\infty$	7070	∞	7092	−0.057	0.000	9.218
0.100	−2462	4972	19.361	4889	0.216	0.462	4.625
0.200	−1793	3353	13.400	3346	0.019	0.570	2.852
0.300	−1558	2141	9.633	2286	−0.378	0.614	2.046
0.400	−1359	1271	6.851	1566	−0.768	0.653	1.633
0.500	−1143	681	4.749	1071	−1.014	0.699	1.398
0.600	−917	312	3.200	714	−1.047	0.750	1.250
0.700	−699	108	2.102	440	−0.863	0.803	1.148
0.800	−490	19	1.327	222	−0.528	0.858	1.072
0.900	−272	−2	0.702	65	−0.174	0.918	1.020
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Rb(liquid)

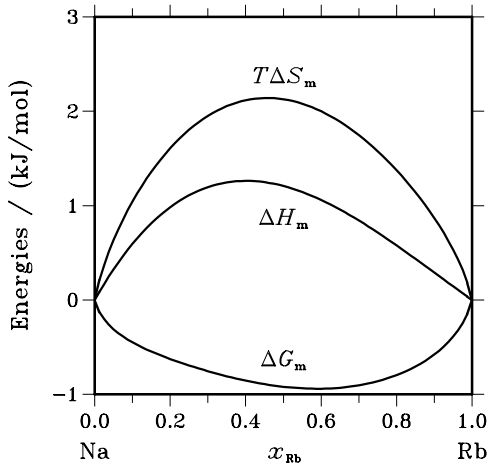

Fig. 2. Integral quantities of the liquid phase at T=384 K.

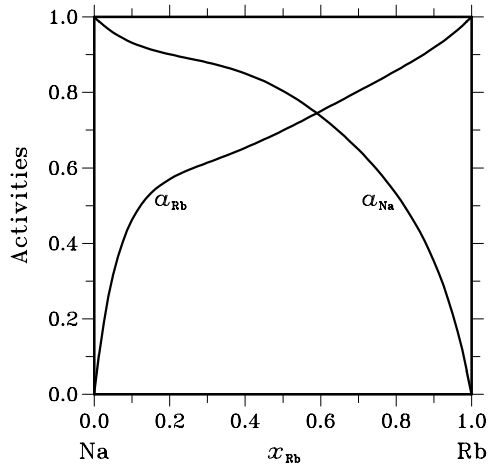

Fig. 3. Activities in the liquid phase at T=384 K.

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