Cu – Li (Copper – Lithium)

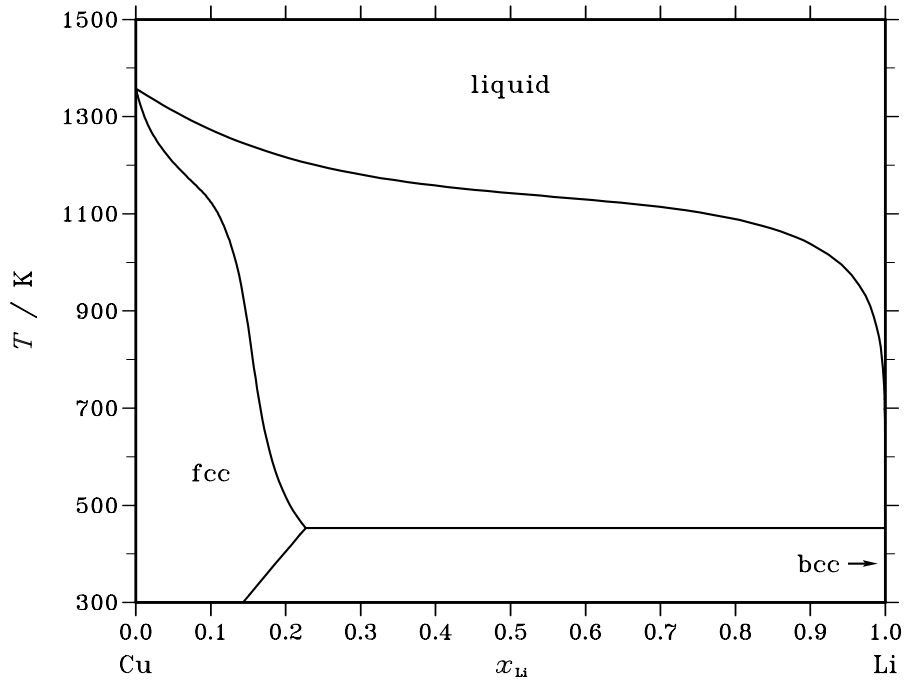

Fig. 1. Calculated phase diagram for the system Cu-Li.

The copper-lithium system is a subsystem of Al-Cu-Li-Mg-Zr which has been investigated in the framework of the COST 507 program on light metal alloys. The system has been critically assessed by Saunders [98Ans]. A critical review of the experimental literature information has been published by Pelton [86Pel]. The phase diagram is rather simple with a eutectic close to pure Li. The liquidus has been determined by thermal analysis by Pastorello [30Pas]. The liquidus is rather flat indicating a metastable miscibility gap in the liquid phase at lower temperature. The solid solubility of Li in solid Cu has been determined by Klemm *et al.* [58Kle]. The lithium content increases in a non-linear matter with lower temperature which is an unusual behaviour. There is a good agreement between the assessment and the available experimental information.

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(Cu,Li)_1$
fcc	$A1$	Cu	$cF4$	$Fm\overline{3}m$	FCC_A1	$(Cu,Li)_1$
bcc	$A2$	W	$cI2$	$Im\overline{3}m$	BCC_A2	$(Cu,Li)_1$

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Li}			$\Delta_{\mathrm{r}}H$ / (J/mol)
fcc + liquid $\rightleftharpoons$ bcc	degenerate	453.6	0.227	1.000	1.000	−3000

Table IIIa. Integral quantities for the liquid phase at 1400 K.

x_{Li}	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	−3479	5940	6.728	305	4.025	0.000
0.200	−5283	10560	11.316	542	7.156	0.000
0.300	−6399	13860	14.471	711	9.392	0.000
0.400	−7021	15840	16.329	813	10.733	0.000
0.500	−7222	16500	16.944	847	11.181	0.000
0.600	−7021	15840	16.329	813	10.733	0.000
0.700	−6399	13860	14.471	711	9.392	0.000
0.800	−5283	10560	11.316	542	7.156	0.000
0.900	−3479	5940	6.728	305	4.025	0.000
1.000	0	0	0.000	0	0.000	0.000

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

Table IIIb. Partial quantities for Cu in the liquid phase at 1400 K.

x_{Cu}	ΔG_{Cu} [J/mol]	ΔH_{Cu} [J/mol]	ΔS_{Cu} [J/(mol·K)]	$G_{\mathrm{Cu}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Cu}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Cu}	γ_{Cu}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−1193	660	1.323	34	0.447	0.903	1.003
0.800	−2462	2640	3.644	136	1.789	0.809	1.012
0.700	−3847	5940	6.991	305	4.025	0.719	1.027
0.600	−5404	10560	11.403	542	7.156	0.629	1.048
0.500	−7222	16500	16.944	847	11.181	0.538	1.075
0.400	−9446	23760	23.719	1220	16.100	0.444	1.110
0.300	−12355	32340	31.925	1660	21.914	0.346	1.153
0.200	−16566	42240	42.004	2168	28.623	0.241	1.205
0.100	−24059	53460	55.370	2744	36.226	0.127	1.266
0.000	$-\infty$	66000	∞	3388	44.723	0.000	1.338

Reference state: Cu(liquid)

Table IIIc. Partial quantities for Li in the liquid phase at 1400 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}
0.000	$-\infty$	66000	∞	3388	44.723	0.000	1.338
0.100	−24059	53460	55.370	2744	36.226	0.127	1.266
0.200	−16566	42240	42.004	2168	28.623	0.241	1.205
0.300	−12355	32340	31.925	1660	21.914	0.346	1.153
0.400	−9446	23760	23.719	1220	16.100	0.444	1.110
0.500	−7222	16500	16.944	847	11.181	0.538	1.075
0.600	−5404	10560	11.403	542	7.156	0.629	1.048
0.700	−3847	5940	6.991	305	4.025	0.719	1.027
0.800	−2462	2640	3.644	136	1.789	0.809	1.012
0.900	−1193	660	1.323	34	0.447	0.903	1.003
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Li(liquid)

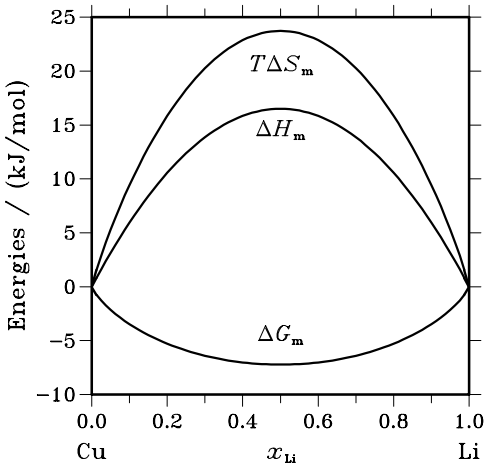

Fig. 2. Integral quantities of the liquid phase at T=1400 K.

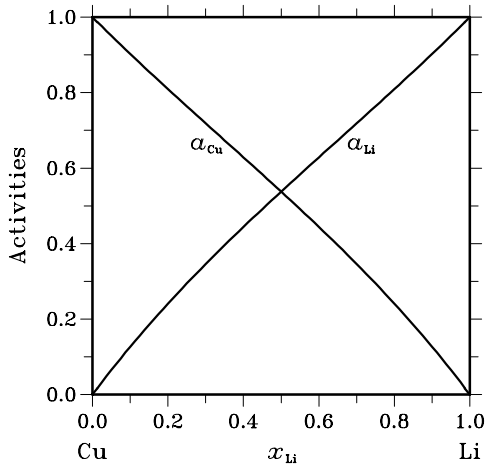

Fig. 3. Activities in the liquid phase at T=1400 K.

References

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