Cu – Sr (Copper – Strontium)

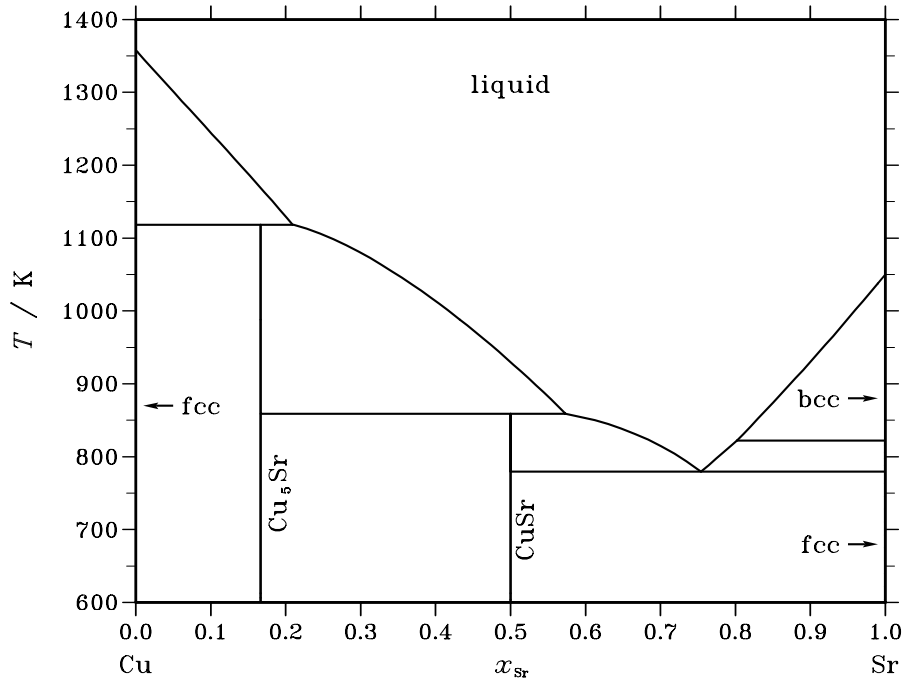

Fig. 1. Calculated phase diagram for the system Cu-Sr.

The Cu-Sr system has been assessed by Risold *et al.* [96Ris] as part on their work on high-TC superconducting Bi-Sr-Ca-Cu oxides. The evaluation is based on the limited available experimental data on the system. The phase diagram has been investigated by Bruzzone [71Bru] and mixing enthalpies in the liquid have been available at 1373 K [91Mik].

Table I. Phases, structures and models.

Phase	Struktur-bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(Cu,Sr)_1$
fcc	$A1$	Cu	$cF4$	$Fm\overline{3}m$	FCC_A1	$(Cu,Sr)_1$
Cu_5Sr	$D2_d$	$CaCu_5$	$hP6$	$P6/mmm$	D2D_SRCU5	Cu_5Sr_1
CuSr	$\cdots$	BaCu	$hP8$	$P6_3/mmc$	SRCU	Cu_1Sr_1
bcc	$A2$	W	$cI2$	$Im\overline{3}m$	BCC_A2	Sr_1

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{Sr}			$\Delta_r H$ / (J/mol)
fcc + liquid $\rightleftharpoons$ Cu_5Sr	peritectic	1118.4	0.000	0.209	0.167	−8335
Cu_5Sr + liquid $\rightleftharpoons$ CuSr	peritectic	859.0	0.167	0.573	0.500	−6080
liquid + bcc $\rightleftharpoons$ fcc	degenerate	822.1	0.802	1.000	1.000	−839
liquid $\rightleftharpoons$ CuSr + fcc	eutectic	779.5	0.754	0.500	1.000	−6320

Table IIIa. Integral quantities for the liquid phase at 1373 K.

x_{Sr}	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	−2865	−2466	0.291	846	−2.412	0.000
0.200	−4138	−3903	0.171	1575	−3.990	0.000
0.300	−4837	−4552	0.208	2136	−4.871	0.000
0.400	−5189	−4619	0.416	2494	−5.180	0.000
0.500	−5289	−4275	0.738	2624	−5.025	0.000
0.600	−5165	−3659	1.097	2518	−4.499	0.000
0.700	−4795	−2872	1.401	2178	−3.678	0.000
0.800	−4090	−1983	1.534	1623	−2.627	0.000
0.900	−2829	−1026	1.313	882	−1.390	0.000
1.000	0	0	0.000	0	0.000	0.000

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

Table IIIb. Partial quantities for Cu in the liquid phase at 1373 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	−1154	−558	0.434	49	−0.442	0.904	1.004
0.800	−2278	−1892	0.281	270	−1.575	0.819	1.024
0.700	−3329	−3574	−0.178	742	−3.144	0.747	1.067
0.600	−4325	−5276	−0.692	1506	−4.940	0.685	1.141
0.500	−5351	−6775	−1.037	2561	−6.800	0.626	1.252
0.400	−6594	−7953	−0.990	3866	−8.608	0.561	1.403
0.300	−8405	−8795	−0.283	5339	−10.294	0.479	1.596
0.200	−11515	−9388	1.549	6858	−11.832	0.365	1.824
0.100	−18025	−9924	5.900	8261	−13.245	0.206	2.062
0.000	$-\infty$	−10700	∞	9346	−14.600	0.000	2.267

Reference state: Cu(liquid)

Table IIIc. Partial quantities for Sr in the liquid phase at 1373 K.

x_{Sr}	ΔG_{Sr} [J/mol]	ΔH_{Sr} [J/mol]	ΔS_{Sr} [J/(mol·K)]	$G_{\mathrm{Sr}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Sr}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Sr}	γ_{Sr}
0.000	$-\infty$	−30700	∞	8842	−28.800	0.000	2.170
0.100	−18269	−19644	−1.001	8017	−20.146	0.202	2.018
0.200	−11579	−11948	−0.268	6794	−13.650	0.363	1.813
0.300	−8356	−6835	1.108	5388	−8.902	0.481	1.603
0.400	−6485	−3633	2.077	3975	−5.541	0.567	1.416
0.500	−5226	−1775	2.513	2687	−3.250	0.633	1.265
0.600	−4212	−796	2.489	1619	−1.759	0.691	1.152
0.700	−3248	−334	2.122	824	−0.843	0.752	1.075
0.800	−2233	−132	1.530	314	−0.325	0.822	1.028
0.900	−1141	−38	0.803	62	−0.073	0.905	1.005
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Sr(liquid)

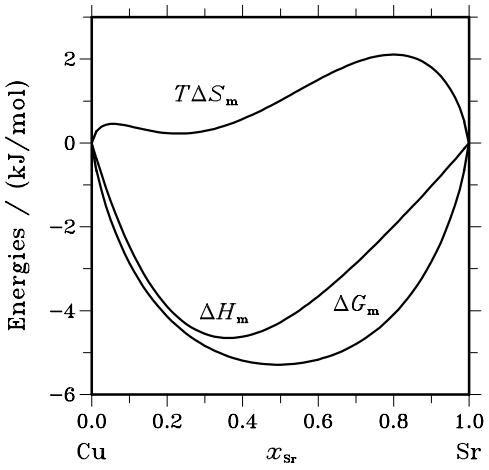

Fig. 2. Integral quantities of the liquid phase at T=1373 K.

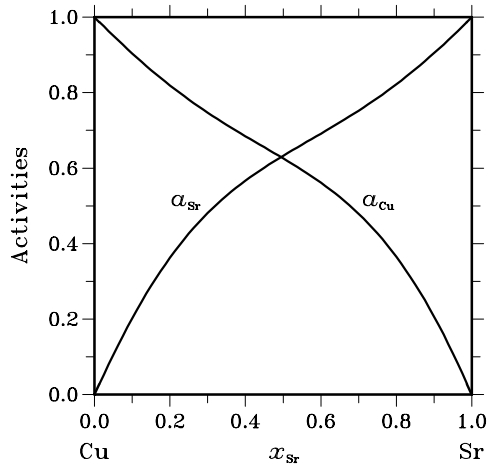

Fig. 3. Activities in the liquid phase at T=1373 K.

Table IV. Standard reaction quantities at 298.15 K for the compounds per mole of atoms.

Compound	x_{Sr}	$\Delta_{\mathrm{f}}G^{\circ}$ / (J/mol)	$\Delta_{\mathrm{f}}H^{\circ}$ / (J/mol)	$\Delta_{\mathrm{f}}S^{\circ}$ / (J/(mol·K))	$\Delta_{\mathrm{f}}C_P^{\circ}$ / (J/(mol·K))
Cu_5Sr_1	0.167	−1983	−1983	0.000	0.000
Cu_1Sr_1	0.500	−1997	−1997	0.000	0.000

References

[71Bru] G. Bruzzone: J. Less-Common Met. **20** (1971) 149–154.

[91Mik] M.V. Mikhailovskaya, V.S. Sudavtsova: Metally **6** (1991) 32–36; transl. : Russ. Metall. **6** (1991) 25–29.

[94Ris] D. Risold, B. Hallstedt, L.J. Gauckler, H.L. Lukas, S.G. Fries: Calphad **20** (1996) 151–160.