Ag – V (Silver – Vanadium)

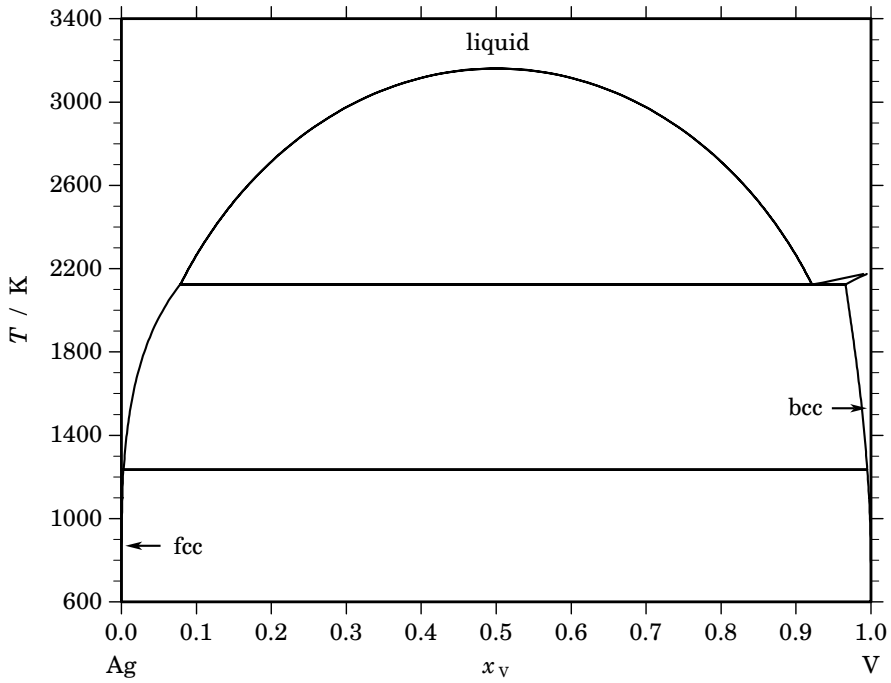

Fig. 1. Calculated phase diagram for the system Ag-V.

Ag-V is a simple system involving one eutectic and one monotectic invariant reaction. The system exhibits the liquid as well as two solid solutions, based on fcc-Ag and bcc-V, respectively. Experimental studies [1915Gie, 1954Ros] reported the existence of a miscibility gap in the liquid phase. With increasing temperature the solubility of Ag in bcc-V increases reaching a composition near 3.2 at.% Ag at the monotectic temperature 2124 K [1989Smi]. The solubility of V in fcc-Ag is negligible.
The Ag-V system has been critically assessed by Korb [2004Kor]. The calculated phase diagram is in good agreement with the experimental thermodynamic data. The small solubility of Ag in solid vanadium is reproduced well by the calculations.

Table I. Phases, structures and models.

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

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_V			$\Delta_r H$ / (J/mol)
liquid $\rightleftharpoons$ liquid′ + liquid″	critical	3161.6	0.500	0.500	0.500	0
liquid″ $\rightleftharpoons$ liquid′ + bcc	monotectic	2124.3	0.079	0.921	0.966	−21632
liquid′ $\rightleftharpoons$ fcc + bcc	eutectic	1234.4	0.002	0.003	0.995	−11335

Table IIIa. Integral quantities for the liquid phase at 3200 K.

x_{V}	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	−3914	4456	2.616	4735	−0.087	0.000
0.200	−4896	7922	4.006	8418	−0.155	0.000
0.300	−5205	10398	4.876	11048	−0.203	0.000
0.400	−5280	11883	5.363	12627	−0.232	0.000
0.500	−5289	12378	5.521	13153	−0.242	0.000
0.600	−5280	11883	5.363	12627	−0.232	0.000
0.700	−5205	10398	4.876	11048	−0.203	0.000
0.800	−4896	7922	4.006	8418	−0.155	0.000
0.900	−3914	4456	2.616	4735	−0.087	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: Ag(liquid), V(liquid)

Table IIIb. Partial quantities for Ag in the liquid phase at 3200 K.

x_{Ag}	ΔG_{Ag} [J/mol]	ΔH_{Ag} [J/mol]	ΔS_{Ag} [J/(mol·K)]	$G_{\mathrm{Ag}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{Ag}}^{\mathrm{E}}$ [J/(mol·K)]	a_{Ag}	γ_{Ag}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−2277	495	0.866	526	−0.010	0.918	1.020
0.800	−3833	1980	1.817	2104	−0.039	0.866	1.082
0.700	−4755	4456	2.878	4735	−0.087	0.836	1.195
0.600	−5173	7922	4.092	8418	−0.155	0.823	1.372
0.500	−5289	12378	5.521	13153	−0.242	0.820	1.639
0.400	−5439	17824	7.270	18940	−0.349	0.815	2.038
0.300	−6254	24261	9.536	25780	−0.475	0.791	2.635
0.200	−9150	31688	12.762	33671	−0.620	0.709	3.545
0.100	−18648	40105	18.360	42615	−0.785	0.496	4.961
0.000	$-\infty$	49512	∞	52611	−0.969	0.000	7.224

Reference state: Ag(liquid)

Table IIIc. Partial quantities for V in the liquid phase at 3200 K.

x_{V}	ΔG_{V} [J/mol]	ΔH_{V} [J/mol]	ΔS_{V} [J/(mol·K)]	$G_{\mathrm{V}}^{\mathrm{E}}$ [J/mol]	$S_{\mathrm{V}}^{\mathrm{E}}$ [J/(mol·K)]	a_{V}	γ_{V}
0.000	$-\infty$	49512	∞	52611	−0.969	0.000	7.224
0.100	−18648	40105	18.360	42615	−0.785	0.496	4.961
0.200	−9150	31688	12.762	33671	−0.620	0.709	3.545
0.300	−6254	24261	9.536	25780	−0.475	0.791	2.635
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0.700	−4755	4456	2.878	4735	−0.087	0.836	1.195
0.800	−3833	1980	1.817	2104	−0.039	0.866	1.082
0.900	−2277	495	0.866	526	−0.010	0.918	1.020
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: V(liquid)

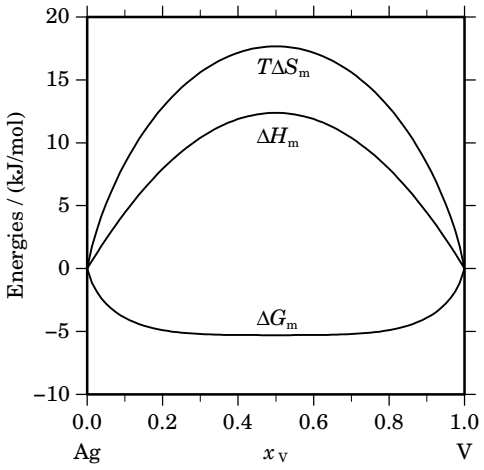

Fig. 2. Integral quantities of the liquid phase at T=3200 K.

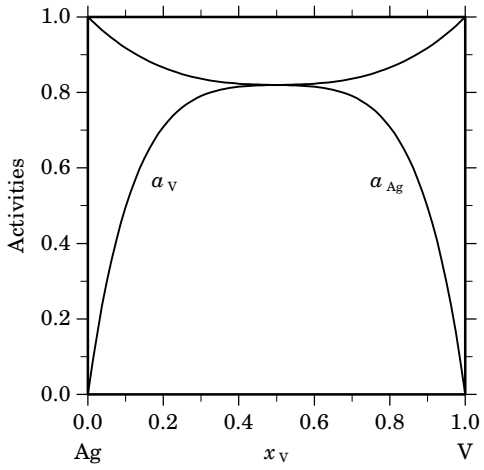

Fig. 3. Activities in the liquid phase at T=3200 K.

References

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